Pit and Quarry

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EUROPEAN POTASH MINING METHODS MAY BE ADOPTED

SEARCH for commercial potash supplies now being conducted by the federal government in western Texas and eastern New Mexico has led to the preparation of a report by the United States Bureau of Mines, Department of Commerce, on the methods and costs of potash mining in Germany and France. Consideration has been given to the possible application of similar methods when mining of the American potash deposits is undertaken.

Nearly 95 per cent of the present world production of commercial potash is derived from the soluble potash salt deposits of Germany and France, state George S. Rice and John A. Davis in the Bureau of Mines report. The estimate of German potash reserves vary from 22,000,000,000 to 3,840,000,000,000 short tons of crude salts. The French reserves are estimated at approximately 1,600,000,000 short tons. The recently discovered deep deposits in Texas and New Mexico are believed by competent geologists and engineers to contain many millions of tons of soluble potash-salts. They are being extensively prospected by drilling, with a view to developing a source of supply which, with potash derived from Searles Lake and other sources of brine, should render the United States less dependent upon the present Franco-German monopoly.

The German potash deposits encircle the Harz mountains, and extend to the northwest under the Hannoverian lowlands to the southwest into Thuringia, embracing a potential productive area which is thought to be as much as 24,000 square miles. The French deposits occur in Alsace in the upper Rhine valley near Mulhouse, and the productive area included about 70 square miles.

The potash salts in both countries are believed to have resulted from evaporation, under hot and arid climatic conditions, of saline water in an arm of the sea cut off by a low barrier or in a large inland lake, the precipitated salts being covered later by sedimentary clays, limestones, and finally sands and gravels totaling many hundreds of feet in thickness.

The more important potash salts mined in Germany include carnallite, a mixture of potassium and magnesium chlorides containing 8 to 10 per cent of oxide of potassium, or K_2O, as mined; kainite, a mixture of potassium chloride and magnesium sulphate containing 10 to 12 per cent of K_2O; hartsalz, a mixture of sodium chloride potassium chloride, and potassium sulphate with 12 to 15 per cent of K_2O; and sylvanite, a mixture of sodium and potassium chloride containing 15 to 20 per cent, or even more, of K_2O. The French potash salts are almost entirely sylvinite and are characterized by the absence of magnesium compounds.

The geological structure makes the depth of the German potash beds extremely variable, ranging from 665 feet to 3,950 feet, or even greater in some of the synclines. However, most of the mining is done at depths of 1,300 to 1,950 feet. The depths of the Alsatian potash mines range from 1,650 feet at the southwestern to 2,850 feet at the northeastern end of the field.

The thickness of the potash deposits in Germany is varied, ranging all the way from 6 to 165 feet thick. The French deposits are much more uniform. There are two beds throughout most of the productive area, the upper being 2½ to 5½ and the lower 6½ to 17½ feet thick.

It is estimated that the German potash reserves could supply the world for from 1,450 to 250,000 years at the present consumption rate of about 15,000,000 short tons a year, the wide divergence in estimates being due to lack of definite information as to actual thickness of the potash salts throughout much of the potential productive area. The French reserves, it is estimated, contain something more than 100 years' world's supply.

Potash salts were first discovered near Stassfurt in two shafts which were sunk in 1851 to permit mining of rock-salt deposits that had been located by deep drilling. The profitable returns from the new industry fostered exploration and ultimate extension of the German potash field to its present limits. The overproduction and keen competition that resulted from rapid growth of the industry led to the formation of a syndicate to regulate prices and to control production and distribution. The syndicate was ultimately placed by law under the direct control of the German Government, which was given the power, not only to regulate prices and production, but also to close down unprofitable mines or shafts, so that 118 out of a total of 224 German shafts did not produce potash during 1926, although as compensation they received a share in the proceeds from sales by the active mines.

The Alsatian deposits were discovered in 1904 during prospecting for petroleum by deep drilling, and the mines which were promptly opened were

operated chiefly under the control of the German Potash Syndicate until the end of the World War, when they were sequestered and operated by the French Government, which ultimately purchased the German interests. The competition between the French and German industries that followed was terminated in 1924 by an agreement which divided the foreign potash market, 30 per cent of the demand being allocated to the 17 shafts in Alsace and the remainder to the German mines; the selling prices, however, are identical for either country.

Prospecting for potash deposits in both Germany and France is necessarily done by deep drilling. Churn drills are frequently used in penetrating the overlying sediments, but rotary core drills are always employed in drilling through the potash salts, with magnesium chloride solution instead of water as a washing medium to prevent dissolving of the core.

The shafts are invariably perpendicular, with a circular cross section and diameters of 13 to 19½ feet. Ordinary hand methods are used in sinking through dry strata, but various methods, including the drop-shaft, freezing, Kind-Chaudron, and cementation processes, are employed in penetrating water-bearing sands and gravels, which usually occur above the potash deposits. The shafts are lined with brick or concrete when the inclosing rocks are dry and the cast-iron tubbing through water-bearing zones.

In deeply dipping deposits the potash salt is mined by overhand chamber-stoping protected by pillars and followed by back filling with waste rock salt obtained from separate stopes excavated in the footwall strata. The methods employed in more nearly horizontal deposits closely resemble those of coal mining, either with rooms and pillars or with an advancing longwall.

Drilling is usually done with electric rotary drills when a heading or an advancing face is driven, but hand drills are commonly employed in stoping. Blasting is done chiefly with ammonia powder, but black powder is sometimes used in the German stopes. The broken salts are generally hauled to the shaft by electric trolley locomotives. Both electrically driven and steam driven hoists are used to bring the salts to the surface in the mine cars. The high temperatures of the rock strata in the potash mines and the occurrence of inflammable gases, particularly in Alsace, necessitate mechanical ventilation moving relatively large quantities of air. Open-flame lamps are still employed in the German mines, but safety or portable electric lamps are required in France. Remarkably little timber is used, as the main levels are often lined with brick or concrete and the stopes are promptly back filled with waste rock salt or waste from treatment plants on the surface.

The crude salts, as they come from the mines, are crushed and either sold directly for fertilizer or treated chemically to remove impurities and increase the potash content of the product. The refining process consists essentially of lixiviation, usually in hot solutions, followed by cooling and crystallization.

The average cost of producing a unit of K_2O (20 pounds per short ton of product) during 1926 in Germany is estimated to have been approximately 30¼ cents. The estimated cost during the same year in France was about 9.6 cents. The lower French cost is due in part to the higher potash content of the crude salts as mined, in part to the simpler refining process which could be used in the absence of magnesium compounds in the salts being treated, in part to the fact that the Alsatian industry was not burdened by "closed-down" mines, and in large part to depreciation of the French franc.

SOURCES OF POTASH

The main sources of commercial potash are the solid deposits of soluble potash minerals, such as carnallite, sylvinite, and kainite; sea water, brines, and salt-lake deposits containing appreciable amounts of potash salts associated with sodium salts; vegetable substances, such as wood ashes, beet-sugar residues, seaweed, and sunflower stalks; animal material, such as wool washings; products resulting from the decay of organic nitrogenous matter, such as Indian niter; dust in flue gases from cement kilns or in the top gases of iron blast furnaces; and insoluble potash minerals, including alumnite, feldspar, leucite, muscovite, and glauconite, all of which contain a considerable quantity of potash.

The first of these sources—deposits of soluble potash minerals—is economically by far the most important and is the only one having any present, world-wide commercial significance, state George S. Rice and John A. Davis in Bulletin 274, recently issued by the United States Bureau of Mines. It furnishes more than 95 per cent of the total potash produced, due almost entirely to the extensive exploitation and development of such deposits in Germany and France. The somewhat similar deposits in Poland, Spain, Russia, Holland, Abyssinia, and India supply a quantity that is relatively unimportant at present, although recent activity, particularly in Poland, Spain, and Russia, presages increased production from these countries in future. The recently discovered deep deposits in Texas and New Mexico are of the solid-deposit type and are believed by competent geologists and engineers to contain many millions of tons of soluble potash salts.

MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

Howard E. Bair

Mr. Bair is General Manager of the France Stone Company.

AGE AND ROMANCE IN MARBLE

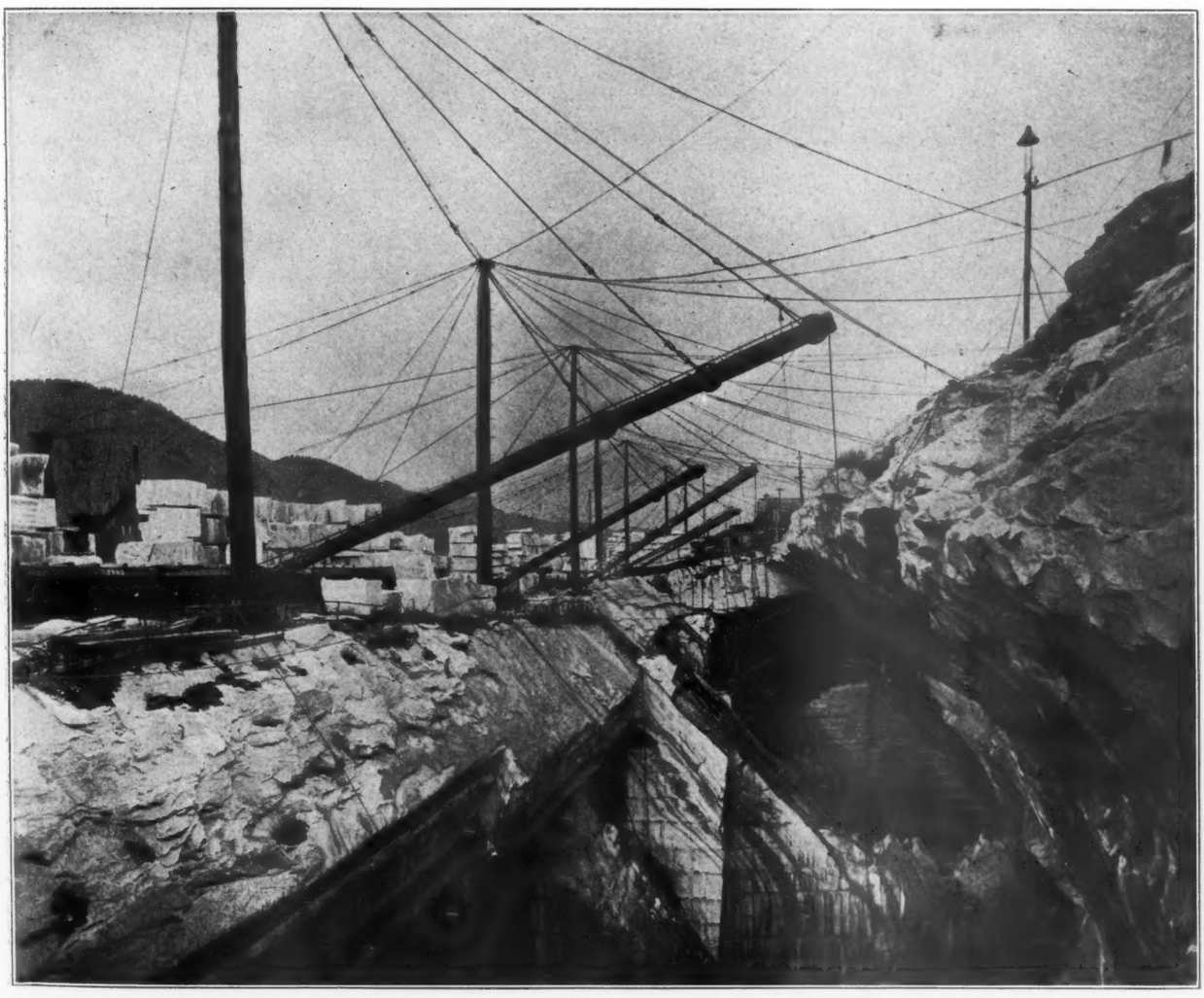
By F. A. Westbrook

THE marble industry has a most honorable and romantic background. Historically it goes back to the oldest civilizations we know of. The most beautiful buildings and the finest sculptures of the ancient world have been in marble and fortunately many examples, thousands of years old, still exist in India, Greece and Italy.

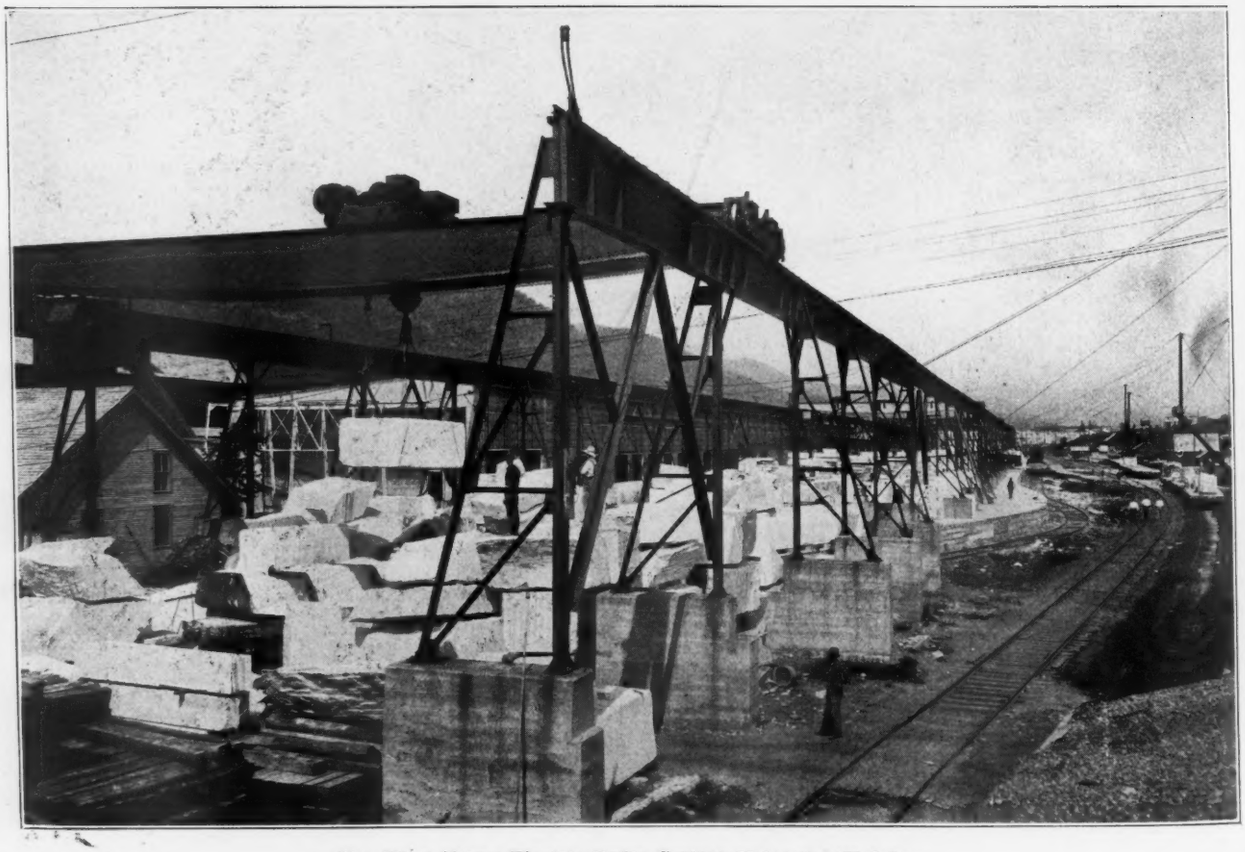
Moreover much of the finest work of the medieval craftsmen has come down to us in the form of marble altars and other decorations in the old cathedrals, and nowadays when some particularly fine piece of work is to be done, it is very likely to be executed in this medium.

Proctor Display Room

Even the natural forces which have produced marble are associated with the strange dim beginning of life on our planet. For instance the marble of Vermont which has the most important quarries in this country, is the result of a series of upheavals, separated by enormously long periods of time and related to the cooling of the earth's surface, millions of years ago. Vermont was then an arm of the sea and during untold centuries the lime producing animalculae made limestone until it was about 2,000 feet thick spreading over a large area. Due to some disturbances, the waters became charged with sediment and for another enormous lapse of time this sediment accumulated, burying the limestone under a thick layer of mud and clay. Then there was a terrific upheaval and the Green Mountains were thrust up out of the bed of the



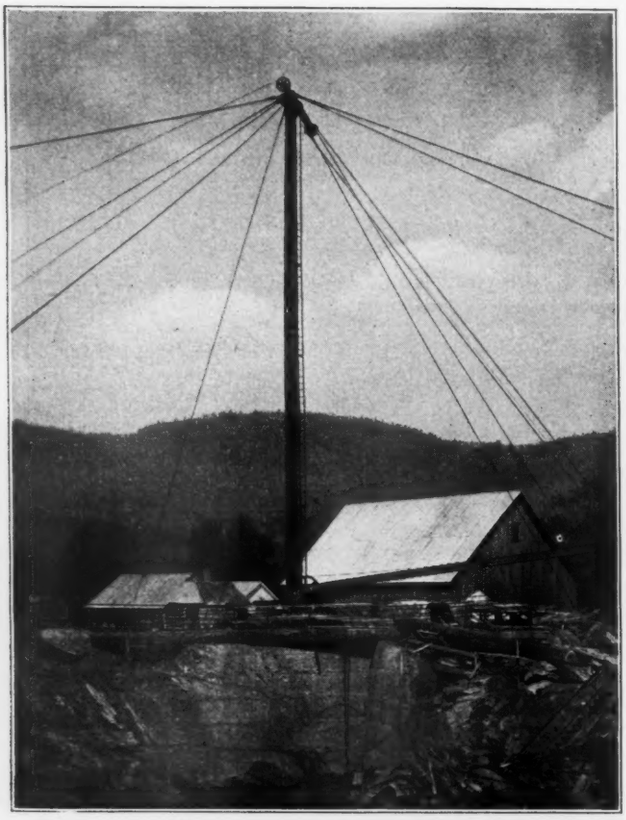
Line of Derricks Over Openings of West Rutland Quarries



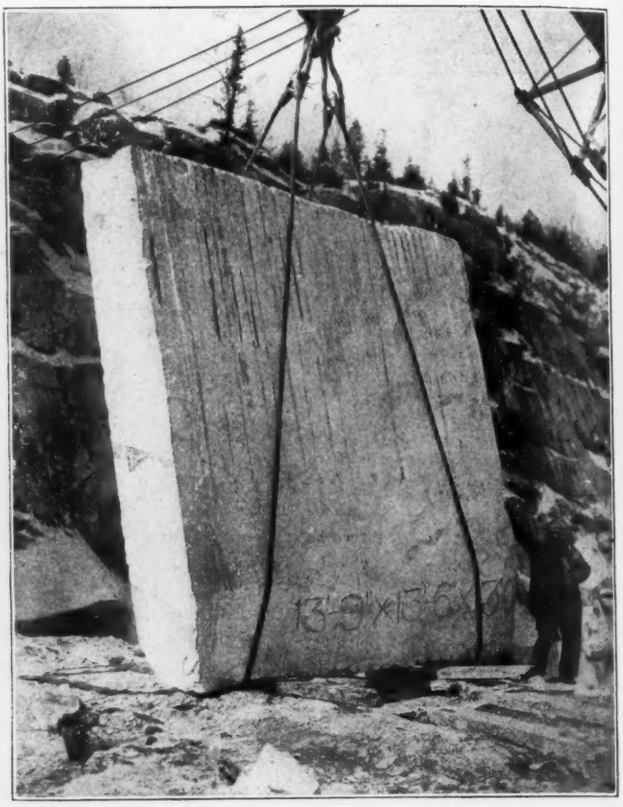
Top View Shows Electric Drills Cutting Holes for Wedging
Bottom View Shows Craneway at Side of Finishing Mill

West Rutland Block Pile and Traveling Craneway

West Rutland Quarry Shows Tracks Entering Tunnel Over Which Blocks Are Hauled Out



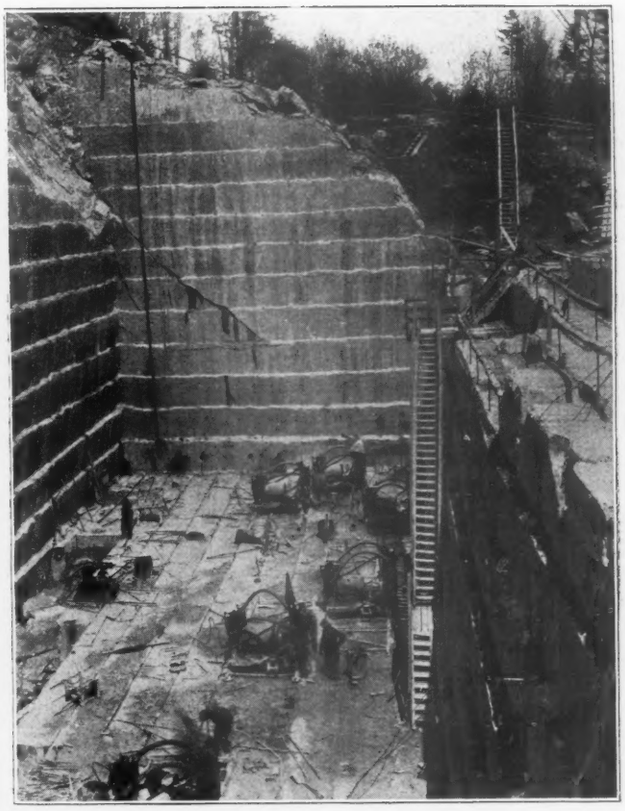
Derrick at Verde Antique Quarry



Fifty-ton Block of Marble

Marble Block Traveling by Overhead Crane

Block Ascending Incline to Surface

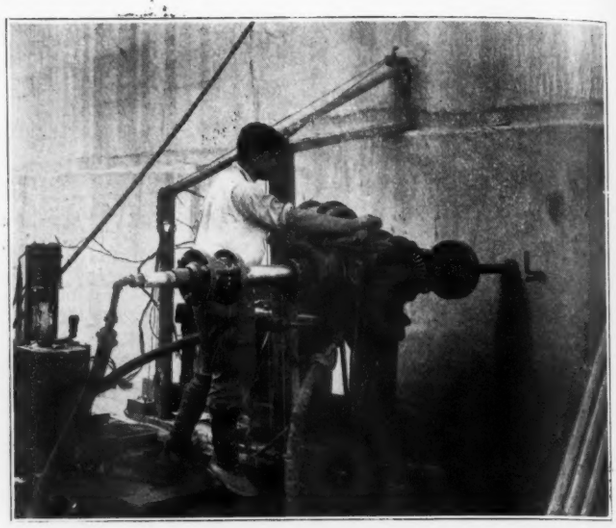


Verde Antique Quarry

Main Quarry West Rutland 700 Feet Deep

ocean. The terrific heat and pressure metamorphosed the limestone into marble with its crystalline structure. Chemically, limestone and marble are alike just in about the same way as coal and diamonds are chemically similar—both marble and diamonds being the result of submitting the cruder forms to such great heat and tremendous pressure that they crystallize.

The marble was of course still deeply buried under the sediment, which incidentally had been largely changed into slate by the upheaval, and it was not until after the sinking of the valleys, the action of the ice caps and the weather that this covering was worn thin enough to bring the marble to view here and there. The fact that this valuable material has been displayed to us by nature in this manner leads one to wonder what new things future ages may cause to be brought to light by the continuation of these processes. Certainly great forces are continually operating all around us which, even if imperceptible during the course of a few generations of men, are nevertheless constantly at work. With all this picturesque past in mind it is with a peculiar feeling of interest and expectancy that one visits a marble quarry with its finishing mills and sees it in association with twentieth century manufacturing methods and power facilities.



Taking Out a 200 Foot Core

Various articles describing certain details in the operation of a marble plant have appeared from time to time in these columns but no attempt has been made recently to give some conception of the

Marble Cutting Mill

Underground Quarry Showing 1100 Feet of Tunnel and Tracks

largest producer in the world—the Vermont Marble Company. It started from the most modest beginnings.

In pre-Revolutionary times slabs of marble were used for fire-place stones by the early settlers in the Green Mountains and during the Revolution marble slabs came to be used for cemetary head stones; and as time went on numerous companies were started to quarry and sell marble for various purposes but about fifty years ago the present company was formed at Sutherland Falls, on the Otter Creek, now known as the village of Proctor. At first there was only one quarry, a small mill and the blocks of stone were hauled by oxen.

At the present time this company has 75 quarries in several different states where 100 channeling machines, mostly Ingersoll-Rand, are used. Shops and mills are located in various places, with a floor space of 27 acres and in which there are 356 gang saws, 112 rubbing beds, 100 polishing machines, 15 lathes, 450 pneumatic tools, 43 traveling cranes, easily over 100 derrick hoisting engines, 110 electric motors. It is estimated that several miles of wire rope are in use for hoists, derrick guys, aerial tramways and so forth.

The greatest concentration of activity is in Proc-

Rubbing Bed Mill

tor and West Rutland, Vermont, with other quarries north and south from Dorset to Swanton. Most of these plants are all tied together with a high tension electrical power transmission supplied with power from six water-power sites owned and operated by the company and generating something like a total of 12,000 horse power.

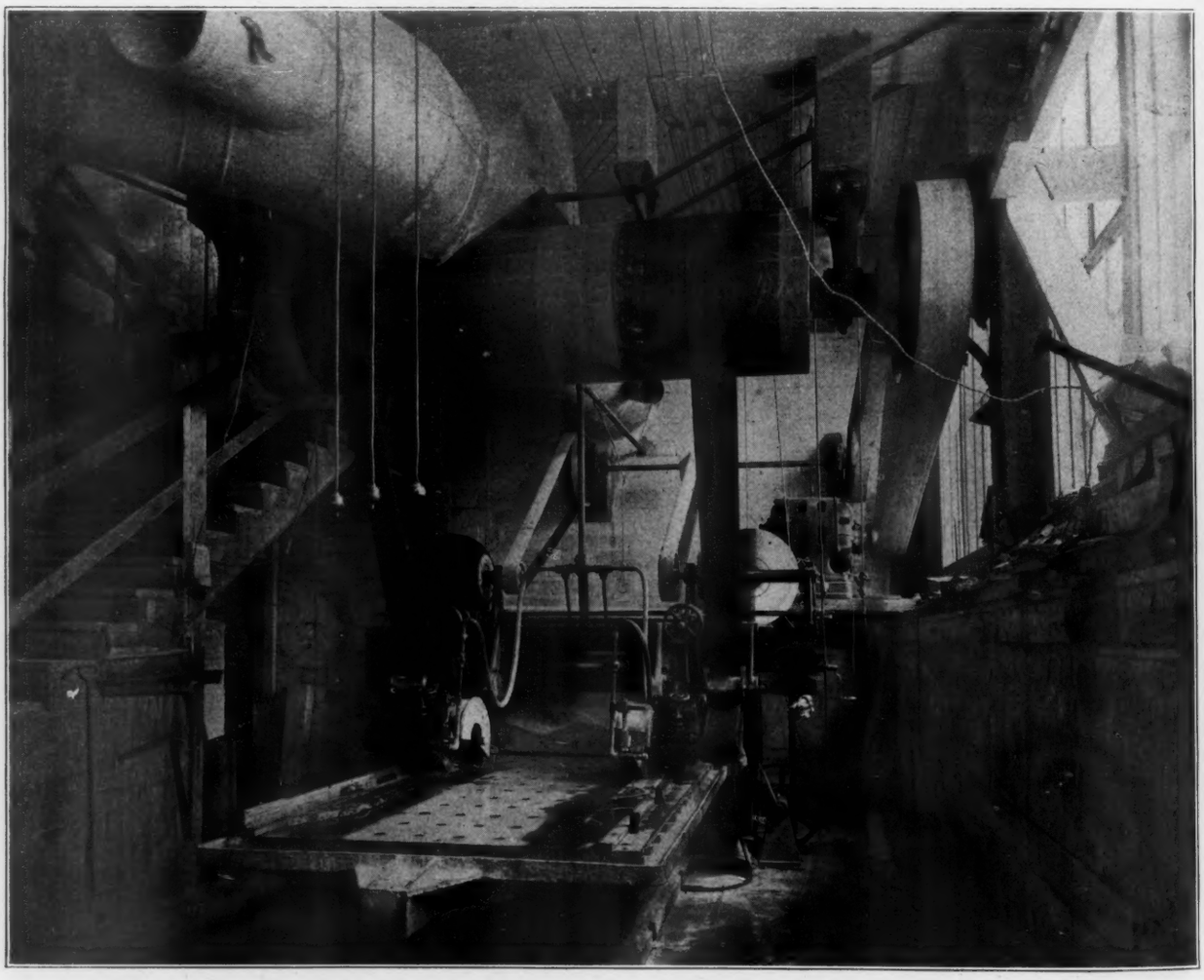
Obviously it is impossible to give a description of all these plants. The best that can be done is to tell as much as space permits of the operations at West Rutland and Proctor, which are only six miles apart. The quarries and many of the mills are at West Rutland and several of the more important finishing shops are at Proctor.

West Rutland has the largest marble quarry in the world. It has been worked for many years, and is now 300 feet deep and has tunnels extending 2,600 feet into the mountain. Here and there immense square columns of living rock left in place to support the roof.

Looking down into the tunnel which slopes rather sharply away from the main floor of the quarry, one can faintly see the figures of the quarrymen moving back and forth at their work. The only light is from scattered electric light bulbs softened by the haze of dampness. Above the roar of the electrical drilling machinery one can hear the frequent shouts of unseen foremen giving directions to the men operating the derricks. There is a feeling of intense driving activity very suggestive of what an operatic impresario's idea might be of the inferno or, perhaps, of a folk tale where gnomes are busily working inside of some enchanted mountain.

The veins of good marble in the quarry have a pitch which varies at different points and which cannot be determined with surety by observation. In order to know in what directions the quarry should be pushed use is made of the very practical Chicago Pneumatic coring machines which can take out a core four to five hundred feet long from the rock at any desired angle. This, of course, gives a good example for inspection and study and by making a sufficient number of these borings the quarry operations can be prosecuted with greater assurance as to the results.

The marble is cut by means of something like 30 Ingersoll-Rand channelling machines in which the travel is by electric motor and the drilling by compressed air. Rome Superservice rubber sheathed cables supply electrical power to some of these. A portion of the floor is cut in a series of



Carborundum Machine. Note Traveling Table and Streams of Water Playing on Corborundum Wheel

long parallel channels about four feet deep and about four feet apart and two others about the same distance apart at right angles to these to form the "key blocks." Then holes are drilled horizontally at the bottom, by means of two or more Ingersoll-Rand jack hammers mounted on a frame, and the blocks are split off by means of wedges. The other blocks are cut off by drilling lines of holes, a faster operation than channelling, at right angles to the channels as well as at the bottom. The result is that the sides of the quarry and the pillars supporting the roof of the tunneled sections are left with a series of evenly spaced horizontal lines where the blocks have been taken out which cause the walls to appear to have been built of enormous stones. The depth of the quarry and the other proportions are on such a great scale that these immense mythical stones do not seem out of proportion. As one descends the almost endless stairway down into the semi-twilight from the bright summer sunshine above, it seems like going down from the roof of some enormous building into the crypt of an immense cathedral, only it is colder than any crypt for there are little patches of ice here and there left over from the previous winter and one actually shivers and has to stamp around to keep warm.

Of course large quantities of compressed air are required for the drilling operations. This is supplied from a central air compressing plant equipped with Bury compressors, described in detail in the November 24, 1926, issue of Pit and Quarry.

Before the large quarry blocks thus obtained can be brought to the surface they have to be hauled in some way to a point under one of the openings. This is done at the present time in three ways. In some cases there is a series of two or three derricks in line under the mountain, placed so that the block is passed by the swinging booms from one to another until a point below the opening is reached.

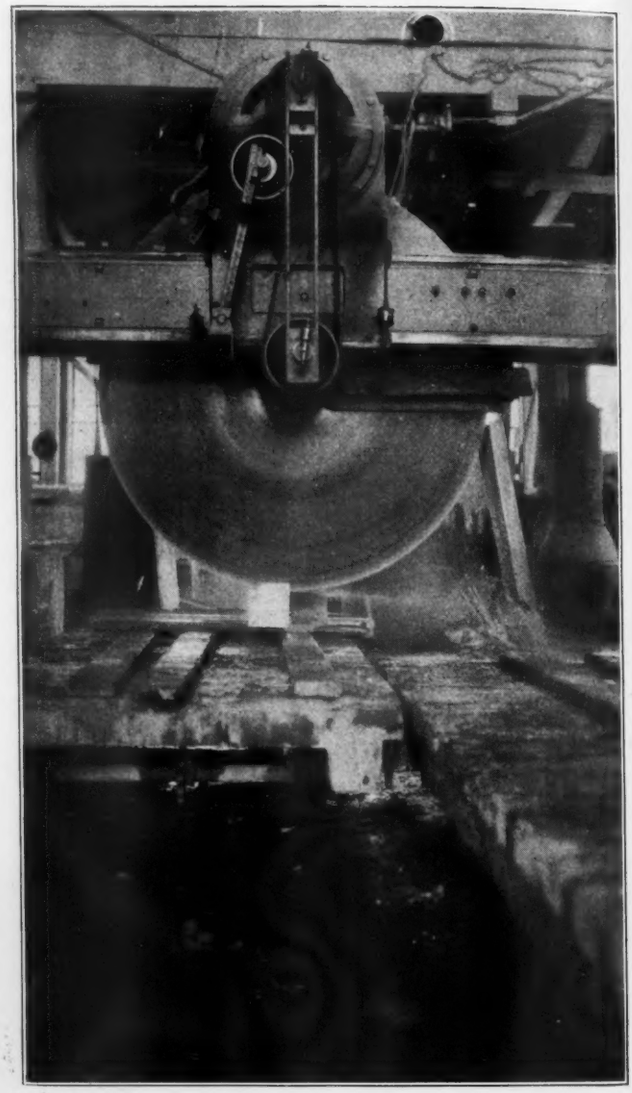
In other locations where the contour of the floor permits, the block is dragged along horizontally by a hoisting engine and is finally lifted on to a car pulled by another engine to the opening, or by electric road in West Rutland quarry. In some of the other quarries the blocks are pulled along the floor all the way to the opening. Lidgerwood and Lincoln Iron Works hoists driven by General Electric Company motors and Roebling wire rope are used for this.

The line of derricks at the several openings into the surface is shown in one of the illustrations. There are equipped with three Patch, two Lincoln

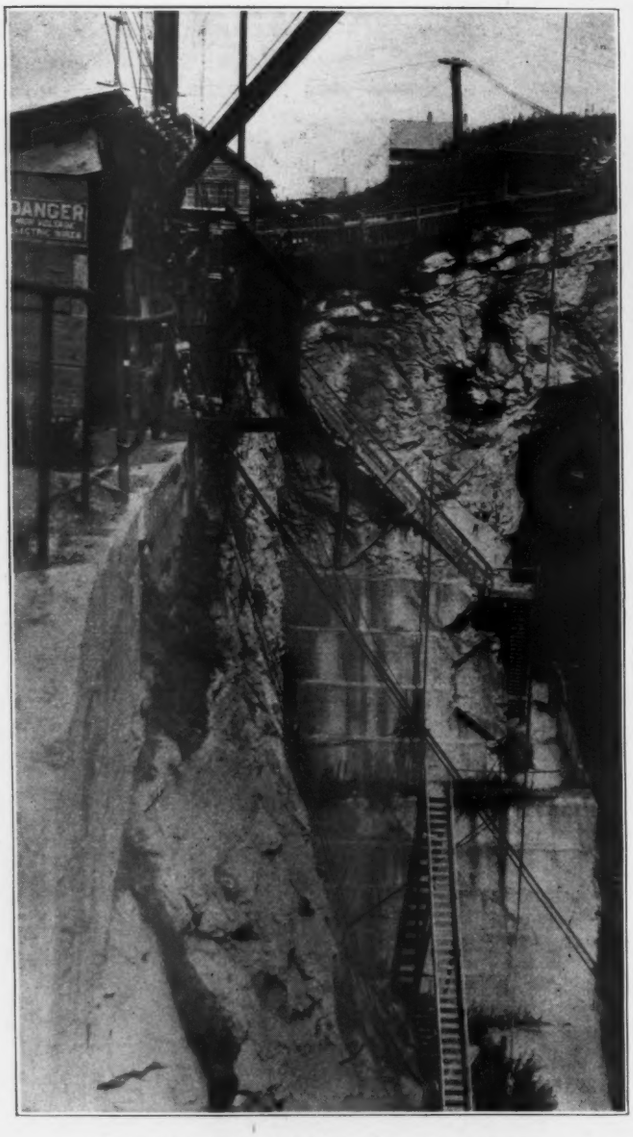
Derricks Used to Haul Blocks Up Incline and Place Them on Cars

Iron Works and one Lidgerwood hoisting engines. Most of them are equipped with Roebling Wire Rope and American Hoist and Derrick Company bull-wheels and parts. In addition to these derricks there is an inclined railway about 500 feet long extending at an angle of about 45 degrees from the surface down into the quarry. Only one of these has been possible because at only one point does the slope of the roof permit of having such an incline. It is of great advantage because the tracks extend well into the quarry and reduce the necessary amount of handling with derricks. The car for this incline is hauled by a Patch hoist, driven by a 120 h.p. General Electric direct current motor and using Roebling cable. The average weight of the quarry blocks is 15 tons although frequently blocks of twice that weight are taken out. At any rate, one rather instinctively avoids standing under the blocks as they ascend, although accidents from their falling very rarely happen.

When these immense quarry blocks reach the surface they are placed on flat cars by the derrick. They are then taken to the mills for sawing. Gang saw mills are located at West Rutland near the quarries and a great deal of stone both for monumental and building work is prepared here. This finishing mill was described in detail in the March 16, 1926, issue of Pit and Quarry but has since been greatly increased in size. The blocks on flat cars are hauled under the craneway by American Locomotive Company's steam locomotives, operated by the Clarendon and Pittsford Railway, where they are cared for by the traveling cranes. There are two 25-ton and two 10-ton Pawling and Harnischfeger cranes traveling on an outside craneway, which is 1,100 feet long and has a 65-foot span. Within the building there are 48 gang saws, made by the Marble Company, and 2 rubbing beds. There is also a Pawling and Harnischfeger traveling crane of 5-ton capacity within the mill to handle the sawed pieces of marble. All of the motors here are General Electric Company.



Saw for Trimming Marble to Specific Size



Stairway Leading Into West Rutland Quarry

A large amount of waste resulting from sawing the quarry blocks here and at Proctor and from the various other operations at the latter place as well as from the quarries is burned at the company's West Rutland lime plant described in the April 15,

1925, issue of Pit and Quarry. Suffice it to say here that this has two Vulcan Iron Works rotary kilns burning producer gas and that what would otherwise be a substantial item of expense has been turned into a profit.

Quarry blocks which are to be used for monumental work or for the ornamentation of buildings are transported to the shops at Proctor by railroad. Here there are 27 rubbing beds, 25 polishing machines, 10 Patch stone lathes, 350 Sullivan pneumatic hand tools and other machines which will be mentioned later. All of these cutting and finishing operations require a great deal of sand and how this is obtained at the rate of 500 pounds every twenty-eight seconds over an aerial tramway on the other side of the mountain from Proctor was told in the October 1, 1925, issue of Pit and Quarry. This supplies sand for the plants in the Otter Creek Valley and the fact that this means the consumption of about 800 tons of sand per day will give some idea of the magnitude of the company's operations and the importance of sand in them.

The polishing machine more or less resembles the electric floor polishing machines which one sees in use in office buildings and the like. There is a comparatively small horizontal revolving disc which is moved about over the surface to be polished. For the first operation the disc is covered with carborundum, for the second with aloxite, for the third with hone (leather), water being used in all three operations, and finally a fourth operation with polishing putty and a felt disc.

Certain kinds of cutting are done by means of a Patch circular saw whose circumference is of steel set with diamonds. It is used to trim off ends and similar operations where the gang saw and rubbing bed are impracticable. It cuts fast and uses a large amount of power, and, with its diamond cutting edge, it is an expensive tool impracticable for reducing the big quarry blocks but useful in speeding up production when it comes to trimming and the like. Two of these are now in use at Proctor and each is driven by a 25 h.p. General Electric Company induction motor. Motor will probably soon be added because they give excellent service.

The carborundum machine is used to trim light pieces of polished marble, such as slabs, to a certain size. Two pieces may be cut simultaneously on the traveling table which is somewhat suggestive of a planer. Other types of the same make of machine are used to make mouldings and the like.

A good deal of the finer sculptural work must be done by hand. Sometimes chisel and mallet are used but wherever possible, the pneumatic tools, mostly supplied by the Chicago Pneumatic Company, are employed. The lighter pieces are made in rooms where they are moved about by hand but there are comparatively few of these. A great deal of the work is done in a large shop served by two 25-ton Niles cranes. It is here where the lathes are installed. Air for these tools is supplied by an Ingersoll-Rand compressor driven by two Westinghouse synchronous motors of 150 h.p. each.

Of course the problem of handling materials in a plant such as this is distinctive because of the bulk and weight of the units which must be moved. Frequent reference has already been made to traveling cranes. In addition to these are a great many Yale, Sheppard, Pawling and Harnischfeger, and box hoists used for placing pieces on the rubbing beds, polishing machines, carborundum machines and so forth. In the Proctor display room there is a small Morris traveling crane to handle pieces on exhibition, and in the outdoor storage yard there are six or seven Patch and Whiting electrically operated cantilever cranes used to load and unload freight cars and dispose of materials. The quarry block storage yard at West Rutland is covered by a 25-ton Niles crane operating on a craneway about 2,000 feet long connecting by railroad with the craneway along the outside of the finishing mills.

However, all movements of material within the plant cannot be made by cranes or on flat cars. Although there are two Yale electric trucks at the Proctor plant for moving materials from one place to another, much of this kind of work is done with stone-boats drawn by horses. Although at first glance this may seem old-fashioned there are very good reasons for the employment of this method. It is because a great deal of the moving of materials is done out of doors and as the winter in these mountains is severe with a great deal of snow, it is a much simpler matter to keep paths cleared well enough for a horse-drawn stone boat than for electric trucks which have to run on wheels. There is an unusually large amount of haulage and storage in the open spaces between buildings so that it has been necessary to put down, outdoors, a flooring of heavy planks because the mud in wet weather or when the frost is coming out of the ground, would otherwise be a serious hindrance.

The above descriptions apply generally to all of the operations of the Vermont Marble Company with the exception of Verde Antique quarry at Roxbury, Vermont. This stone is so much harder than ordinary marble that special means are necessary in each stage of its production and manufacture. For instance, all four sides of the quarry blocks must be cut with the channelling machines and as cutting is also slower, it takes an unusual number of these machines to turn out the necessary number of blocks. The finishing mill for this quarry is at Swanton, Vermont, and the operations carried on there must be given special attention on account of the hardness.

RURAL HIGHWAY MAINTENANCE

By F. B. Wilkes

Superintendent of Roads, Maury County, Tennessee*

RURAL Highway Maintenance has until recently been given little attention but the importance of it is now generally recognized and it is claiming the efforts of some of the best road men of the country. It has been demonstrated that our old time methods will not produce the results demanded by modern traffic. We have approximately one thousand miles of roads in Maury County, Tennessee, seventy-five miles are maintained by the state, of which forty-two miles are paved. The other nine hundred twenty-five miles are maintained by the county.

One hundred miles of the principal roads, designated by our law as special highway, are maintained by a fund amounting to one hundred fifty dollars per mile raised by a wheel tax on autos and trucks. For the eight hundred miles of district roads we have an ad valorem tax on property amounting to twenty-five dollars per mile. In addition we have commutation tax on men from eighteen to fifty years, and a tax on wagons, totaling to thirty dollars per mile, but a large percent of this tax is worked out. We also have a bridge tax for the construction and maintenance of all spans twelve feet and over. In 1924 we began the expenditure of a bond issue of one thousand five hundred dollars per mile on the hundred miles of special highways.

We are using motor patrol, having two one-man motor graders and a four-blade maintainer pulled by light tractor and cover ten to twenty miles and return depending on conditions. Every two or three months a blade grader pulled behind the tractor follows to open ditches. About once each year we find it beneficial to scarify and re-shape with heavy grader. With the travel, averaging two hundred to four hundred vehicles per day, a coat of gravel or chert will last about five years. This material costs ten cents per yard at bank, and from twenty-five to seventy-five cents to put on roads.

Reports from various county officials in several states on my committee indicate a live, healthy interest in county road work. They report definite systems and plans for future work of which the following are extracts.

Mr. Rotering of Trempealeau County, Wisconsin, reports that maintenance work in his county has grown from one thousand dollars in 1916 to one hundred sixty-one thousand dollars in 1926.

Report of Mr. Lehner of Macomb County, Wisconsin, shows a well developed system. His county is divided into four districts with a division superintendent in each district. October 1st, each year his funds are budgeted. Especial mention should be made of Mr. Lehner's "Weed Burner" which was designed and developed by himself. For dragging gravel surfaced roads, a one-man operated grader, equipped with scarifying attachment, is used. Each grader is scraping approximately twenty-two miles of road per day, making an operating mileage of approximately forty-four to forty-five miles.

Mr. Anderson of Medina, Ohio, stresses the importance of having a county garage and warehouse, where, during the winter months, all equipment is overhauled and painted. Snow removal is a problem with them and requires the use of snow fences.

This being a coast county, Mr. Jervey, County Engineer, Charleston County, South Carolina, has a difficult and expensive problem in maintaining causeways and drawbridges, connecting the islands. He reports four hundred miles of county road, one hundred miles being surfaced with gravel, shell, sand, clay or other local material and is trying to obtain rights of way forty to fifty feet wide depending on importance of road.

Mr. Hill, County Engineer, Sussex County, Delaware, has an enormous mileage of rural county highways. It has been necessary to turn to machinery and an organization to work throughout the year. Most of the machinery consists of one-man tractor graders. Having twenty-two one-man tractor graders, one ten-ton tractor super mogul grader outfit, one six-ton tractor Stockton sixty grader outfit, one five-ton tractor super special grader outfit, one three-ton roller, as equipment, it has been possible to cut expenditures in half, and do about four times as much work. It was found that a one-man tractor grader outfit could do as much work for seven dollars and fifty cents as a team could for thirty-two dollars. The tractor being county owned and the team being hired from first one farm then another. Roads that were gone over with a scraper not over once a year are now gone over with scraper from fifteen to twenty times a year. The big grader outfits have been used to widen and drain narrow roads at a fraction of the cost by the old method of team and labor. By the use of big graders grubbing is eliminated, and a big saving effected. Instead of plowing, all dirt roads are scarified, making another saving.

The maintenance of county or rural highways calls for hard work, never ending patience, and tireless efforts. Sussex County is constructing some slag roads, which have been very successful and planning to invest what it has saved, in some form of low cost road.

*Abstract of paper delivered before the American Road Congress, Cleveland, January 11, 1928.

TRUCK OPERATIONS IN QUARRIES

By F. S. Jones
Production Engineer, General Crushed Stone Company*

THE subject of truck operations in quarries is one to which it is exceedingly difficult to do justice in a short time. I am also handicapped this afternoon by the presence in this group of the superintendents of those plants at which we use trucks for transporting stone from the quarry face to the initial crusher. Mr. McKeon of our Winchester, Massachusetts plant and Mr. Jacoby, of our White Haven, Pennsylvania plant. With the knowledge of their presence and, of course they will give careful attention to my remarks—I am forced to give you only the facts as I know them and am prevented from indulging in any financial flights which might, perhaps, make this discussion somewhat more interesting.

Even though the time were much longer, I could not attempt to give you specific information which would be particularly helpful in determining whether or not the use of trucks in your quarries would be advisable or economical. In other words, I am sure that trucks are not a cure for all of the evils of rail transportation, but that they do have a definite place in quarry work as do steam and gasoline rail equipment. Of course, the use of trucks with shovels of one-half to one yard capacity in quarry work is not a late development, but I do not think that it was considered feasible to attempt the transportation by truck of ten to twelve yards of stone, loaded by a three or four-yard bucket, until about two years ago, and I believe our company was among the first to attempt this combination.

Our first installation was at Winchester, Massachusetts, where we replaced three twenty-ton, thirty-six inch gauge locomotives, thirty-five or forty-five yard contractor cars and the necessary rail and track system, with three, seven and one-half-ton trucks equipped with heavy bodies which have a maximum capacity of approximately twelve tons. These bodies were especially built for us by a well known manufacturer of quarry cars, the design being the result of the experience of that company and ours, the most important point next to the strength and ruggedness of the body itself being the automatic rear door which permits of a free discharge of material. (This truck door is an adaptation of a one-way door for quarry cars originated and developed by John Rice, Jr.) These three trucks and the drivers replaced the locomotive equipment, the operation of which involved the services of six men, and in addition, this change avoided the necessity of a force of men constantly engaged in shifting and repairing quarry tracks. I might state here that it is necessary, however, with the truck operation to employ one man whose duty part of the time is to keep the roads free from stone that may be dropped from the trucks. There is also some expense for maintenance of roadways, particularly near the crusher where all roads converge. One company, I understand, is planning to overcome this difficulty by the construction of a short section of concrete roadway.

On first thought it might seem that labor saving alone would justify the substitution of trucks for steam equipment, but in our opinion this is not the case unless a number of other conditions are favorable to this mode of transportation. For instance, at Winchester our average length of haul is seven hundred feet. The quarry floor is practically level; the initial crusher of the jaw type is below the quarry floor and local conditions require the absolute elimination of mud capping. We desired an increased production and believed that the plant would have a greater capacity if we should feed the stone to it more steadily and uniformly. The results justified our expectations both as to increased production and in operating costs per ton, although this reduced cost was due in our opinion more to the increased production than to more economical means of transportation.

Shortly after the purchase of trucks for the Winchester plant, we decided to increase our capacity at White Haven, Pennsylvania by changing from a hand to a shovel loading operation, installing a larger initial crusher and using trucks for transportation. At this plant we have a short haul averaging about six hundred feet, although we are handicapped by having a ten per cent grade for a distance of about one hundred fifty feet from the crusher. Eventually this grade will be almost eliminated by filling in the quarry floor. At first we used two small revolving shovels with one and one-half-yard buckets, but found that we experienced too much delay in loading the trucks, which led to the installation of two railroad shovels equipped with crawling caterpillar tractors and with three and one-half yard dippers. It must be borne in mind that the mobility of the trucks can not be utilized to the fullest extent unless the shovels are equipped with crawlers. The trucks at White Haven are loaded with only about eight tons per trip as compared with the average load of eleven tons at Winchester. This difference in loading is due primarily to the grade at the White Haven plant. At this plant we do not have the opportunity of making a direct comparison with a locomotive operation, either as to cost or plant capacity, as we have at Winchester.

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Our opinion of the use of trucks at these two plants speaks for itself in that we decided within the past few days to replace the locomotives quarry cars and accompanying equipment at our Glen Mills, Pennsylvania plant with trucks and bodies of the same general type as we have used for the past two years at the other two plants.

I am going to avoid the specific consideration of actual operating costs, although I know that this feature is probably foremost in your minds. My reason for this is that the actual costs vary so widely with different conditions of grade, length of haul, method of dumping at the crusher, time at the shovel in loading and other considerations which will readily occur to you.

Also, it is difficult as yet to arrive at the proper figures to be used for depreciation and other overhead expenses. At present we are using as a basis of depreciation a life of five years, but we are inclined to believe that at a cost of $500 per year, or possibly even less, we may continue to operate these machines over a ten-year period. This thought must be modified by the possibility of the trucks becoming obsolete in that period due to the continued rapid development of machines of this type. For example, the trucks which we have recently ordered for our Glen Mills plant of the same make as those used at the other plants are somewhat different in construction. This difference is mainly one of heavier springs and chassis members, the desirability of which has been determined by experience. These trucks will undoubtedly last considerably longer and I might emphasize at this point that trucks cannot be made too durable for the work which they have to do.

Another problem which confronts us and which is still in the process of development is that of side dump trucks as compared with end dump machines. If the side type can be brought to the point where the capacity is equal to that with the end door, it probably will replace to a considerable extent the end door body. However, at present the disadvantages of the side type are quite pronounced. The body must be a foot or eighteen inches higher than that with the end gate, thus adding to the danger of upsetting on a rough road as the load is increased. This is unavoidable due to the necessity of the body being sufficiently high to dump the load over the wheels. The side dump truck must be used in connection with a crusher that has an opening capable of taking the load from the entire length of the truck, or it must be dumped far enough above the crusher to permit of the construction of a chute which will narrow the flow to the crusher. It can be readily seen that if the truck carries only one-half as much as the end door type, the mileage and consequently labor expense in connection with the truck operation must be doubled. However, some quarrymen lose one advantage of the end dump type because of the omission of the tail gate. The gate, of course, makes it possible to load at least one more bucket which increases the production from ten to twenty per cent. Another point is that the side dump truck is not nearly as desirable for other purposes when not in use at the quarry. The advantage of the side dump truck is chiefly the time saved by proceeding in a circle and avoiding the necessity of backing to the crusher, as is necessary with the end door body. Also, with the end dump truck it is necessary to equip each one with a hoist at a cost of approximately $500, while with the side dump one hoist at the crusher at a cost of approximately $250 serves all of the machines. I understand that another difficulty which has arisen with the side dump is the unusual strain on the chassis and spring, as seventy-five per cent of the weight of the load and body is concentrated on one side and twenty-five per cent on the hoist when the body is dumped. It would appear, therefore, that in developing the side dump body it is necessary to make a special design for the springs.

The maintenance cost of the truck body and the extent to which it is damaged is not as excessive as might be imagined due partly to the ability of the driver to place the truck in the most advantageous position with respect to the shovel, thus permitting the shovel operator to drop the load from the dipper carefully and without loss of time.

Other details to which it seems impossible to give careful attention at this time are types of hoists, whether mechanical or hydraulic, width and kind of tires, whether single or dual (I might say that one company made a thorough trial of rubber tires sheathed with steel and studded with steel cleats, which was not altogether successful), whether or not the chassis as now produced by most manufacturers is sufficiently heavy in construction as to springs and structural members and whether or not the frame should be trussed. Another question is that of drives, although at present the chain drive is preferable even though occasional trouble develops in the breaking of chains. The individual also must decide at his own operation whether it is desirable for him to use the truck as a feeder at the initial crusher; by this I mean, dump part of the load, wait until the material has passed through and then dump the remainder, or build a reserve storage arrangement adequate to permit the truck to dump its entire load and depart at once. I think that most of us prefer the latter method if it is a possible arrangement. In any case, the dump should be such that the necessity of throwing all of the stone directly against the crusher should be avoided.

You will understand, of course, that in this entire discussion I have had in mind the conditions existent in the types of quarries with which most of us are familiar and which have a daily production ranging from 500 to 5000 tons.

To summarize briefly, the situation is so far as it deals with trucks in quarries, I shall mention first the disadvantages. There is some distance in length of haul from the face where I do not believe trucks would be economical and I am frank to state that I am hesitant to hazard a guess as to this theoretical distance. Grades, as they increase in percentage, add rapidly to the operating cost until a point is reached where truck haulage becomes impossible. The ideal consideration is to haul from a level quarry floor to a crusher located sufficiently below the floor elevation to make it possible to dump from the truck to a small storage bin from which the initial crusher is fed. If, however, general quarry conditions are such as to warrant the investment in trucks, certain advantages are apparent in making comparison with rail equipment. First, greater mobility enabling the shovel to work in the best part of the bank; second, simplification of management—a result of less equipment: third, lower delays due to blasting and drilling which is conducive to a steadier flow of stone to the crushers; fourth, elimination of mud capping which not only assists toward lower blasting costs, but avoids complaints which frequently arise from blasting which, in some thickly populated localities, is of vital importance; fifth, elimination of track shifting and maintenance with the incidental delays and costly derailments; sixth, consideration of safety factor—avoidance of necessity to operate close to a high, dangerous bank and also the hazard to brakeman and switchman of moving trains; seventh, usefulness for other purposes when not engaged in the quarry. Nevertheless, despite these apparent advantages, I am firm in the conviction that it is not economy to change from a rail to a truck operation unless it is desirable to obtain an increased production and the plant is at the same time capable of assimilating such an increase, and I wish to again point out that the natural conditions, as well as the equipment, must be carefully analyzed and studied before the decision is reached to adopt this mode of transportation.

False Credit in the Highway Industry

By Alan Jay Parish*

This survey is treated in three divisions of which the first is the Condition; second, the Causes; and third, the Suggested Remedy.

The condition of the Highway Industry is a sick and precarious one. Contractors have paid for the privilege of returning a great service to the general public, because the average price of all work is taken at or below the cost of production.

The cause is that after the war there was such a scarcity of contractors that concessions were made and much publicity was given to opportunities offered contractors, which resulted in the development of new competition. Many new contractors suffered severe losses and due to their lack of experience and ignorance of conditions not only lost their money, but deprived others of favorable contracts and lowered prices to the level of today.

Bankers, aware of the earnings of the successful contractors, extended large credit to others engaged in the business and now find themselves pouring good money into a great cavity in the hope that their client will strike it lucky and make good his obligation. Bankers have guaranteed sufficient funds to answer the purpose of the Standard Questionnaire to assist their clients in being awarded a new job. Bonding companies have furnished certified checks for bidding purposes to unreliable contractors.

The unstable contractor, having been given this unscrupulous aid, is low bidder, secures the job and starts shopping for equipment and material. He is not shopping for prices but for credits. The machinery manufacturers agree to sell the equipment on a little or no down payment and accept the already worthless notes knowing that they either must renew the notes or repossess the machinery. At times the contractor has purchased machinery on those conditions and mortgaged it to procure working capital. The material man, to get a settlement for his contractor and anticipating a settlement grants a written release and makes an affidavit that the contractor has met his obligations. This, of course, nullifies the lien laws and if there is insufficient money to satisfy the claims, the material man must quietly charge off his losses. This unusual situation is the result of extending false credits.

The remedy is for us to solve the problems of loose financing, unjustified bonding and the extension of false credits. The questionnaires developed by the state and municipal departments have served their purpose but in many instances have caused our competitors to swear to a lie. We, who pay our bills promptly, should unite, through our associations and adopt some plan whereby our willingness and ability to pay cash for our requirements are of some substantial benefit. The Illinois Association has evolved a plan, that each of its members shall receive a discount for meeting all bills on the tenth of the month for all equipment and material supplied during the preceding month. It expects to go farther and guarantee the discounting of the material bills by members of the association. Then it will be up to the producer, whether he cares to do a cash business with the contractors who will be doing 90 to 95 per cent of the business or with the 5 or 10 per cent of the operations who are not responsible for their obligations.

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PERSONAL INJURY ACCIDENTS

By W. H. Weitknecht

General Superintendent, Lehigh Portland Cement Company*

PERSONAL injury accidents and their prevention is an old, old story, so old I think that none of us here can recall the time when we did not hear more or less about it. Many of us recall the more or less intensive agitation that followed every fatality or accident of unusual severity, and many of us are reminded of Mark Twain's witticisms about the weather, that "Everybody seemed to talk about it but nobody had ever attempted to do anything about it" and probably for the same reason.

How many persons are there today who view personal injury accidents as an avoidable evil and entirely preventable? What person or persons employed in industry or having much charge of its management still maintain that while accidents can and must be reduced their complete elimination of 100 per cent prevention is as hopeless as trying to change the condition of the weather would be.

We hear a great deal about evolution these days without many of us understanding much about it, but what little we do know from others who know a great deal about it, makes us wonder why anybody would object to it or refuse to believe it.

So we hear a great deal these days about accident prevention from those who have really succeeded in preventing accidents, but still we find many people skeptical or downright unbelievers in the actual possibility of even a ninety or ninety-five per cent reduction in the present number of industrial accidents, while a 100 per cent reduction or a belief in their total elimination is, in the opinion of the vast majority, as hopeless as finding the end of the rainbow. Truly, accident prevention is another evolutionary development and many of us have seen its development since its emergency from the shell of slow progress to an almost erect form.

First it was, "Everybody for himself and the devil take the hindmost," unguarded places, unguarded machines. "Hurry up there, John, will it take you all day to come across that plank?" Then came the day of safe places and guarded machinery, but with the speeding up of production machines, which largely offset the otherwise effectively guarded condition followed by the still further development almost to perfection of such machines in their automatic operation. Still, the number of personal injury accidents appeared to increase until there were few, if any, who dared hope that accident prevention would ever overtake the increasing personal hazards in industrial development. And this will, no doubt, remain true as it applies to new or strange and distinctly different developments.

The seeming hopeless efforts to stem the tide of increasing accidents caused those most interested in accident prevention to compare notes, exchange views and by their study of accident causes pointed out a new way. It was the road that leads to the man himself, a road of much more rapid progress. We all knew, in a way, that the great majority of injuries to workmen resulted from carelessness, either immediate or remote; that the man himself, the next one to him, or the man who went that way before him or who did or did not do something to the machine or the job before it was delivered to the victim caused the accident which no mechanical guard could possibly prevent.

As is always the case, there were those who did not flinch as the largest problem was presented to them, and the Safety Committee Among Workmen idea was born. For a number of years this idea has been developing and yielding results from nothing to brilliant achievement, and again a problem was presented that required an analysis for solution. Why such varying results from so similar methods? Why do the safety committees in some plants establish accident prevention records only to be superseded by subsequent better records? Why do some utterly fail?

Again, after due investigation, comparing notes and making deductions, there would be heard almost at the same time coming from different quarters the exclamation, Eureka! Eureka! and the results that have since crowned the efforts of accident prevention work indicate that they indeed have found it. It is the road that leads to management, directing or supervisal, but preferably both. The superintendents and foremen as representing the supervisal management must be the wheel horses, and fortunate are they if the ownership or directing management lends their aid in either pulling the load or lightening it by providing the proper facilities.

This brings us to the heart of the problem, and I do not know that a great deal of vital importance remains to be said except that the success or failure of the accident prevention work espoused by management is determined by their attitude towards it. If it is the old attitude that accidents will happen in spite of all you can do to prevent them, I predict only indifferent success, but if it is the new attitude that we can no longer differentiate sharply between the responsibility of employer and employee in the matter of accident

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causation, that attitude that recognizes that personal injuries and fatalities resulting from accidents are preventable, and assumes the larger part of the responsibility for their prevention, I predict such results that will astonish even the most optimistic.

The program to be adopted depends upon the size and the nature of the industry and the type and intelligence of the employees, and I have faith that a management capable of operating successfully any enterprise has enough intelligence to construct a program of effective accident prevention work to meet the requirements of the operation of the plant or industry, and what follows in this talk is merely suggestive.

First. A safety committee composed of superintendent and foremen and some one or two key men from each department, depending on the size and organization of the plant or industry.

Second. A meeting of all employees in a mass meeting or in groups to be enlightened on the subject and the purpose of the work. If you can secure their interested cooperation otherwise, let that plan prevail.

Third. Regular meetings of the safety committee (not too often, semi-monthly should be sufficient) with reports from subcommittees out of the general committee detailing:

(a) Inspections to discover unsafe places and unsafe practices, with especial attention to unsafe practices. This committee needs a diplomat for a chairman, for it can easily throw a monkey wrench in an otherwise smooth running machine.

Determine the cause of the accident and see that it doesn't happen again. That is your corrective accident prevention, but the horse is stolen. You have merely locked the stable to keep the next one.

What you want to do is to have an inspection committee that makes inspection of your plants, of your quarries, of all the operations, to determine what unsafe places exist, where the possibilities for an accident are; and still more, and far more important than that, inspect for unsafe practices, those things which result in personal injury accidents which could with reasonable care and forethought have been prevented and which are responsible for 95 per cent of the accidents. Why, then, not look after the practice of your men, the safety practice. That is the way to develop safe habits. Who must do that? The supervising management must assume that responsibility. The foreman must insist upon it.

What would you think if your foreman had as little concern about the method of how some of the men operate your machines as he apparently has of the way the man goes about his business? You insist that a machine be handled properly, you give his methods, and you give his instructions as to the method of operation. You want that machine to do its best work. You want to keep it from being wrecked or worn out too readily. What about the individual? Are you insisting with equal positiveness, with equal insistence that your foreman supervise the practices of your men for their safety in the matter of the clothing they wear, in the matter of the shoes they wear which may incur possible hazard, in the way they perform their work; things that are dangerous either to themselves or to their fellow workmen; in the way they let things lie around; in the way they clean up the job after they are through to prevent possible accident to some fellow workman who may follow? That is one of the most important things that inspection committee can do, inspect for safe practice. They are the keynote of accident prevention work.

(b) Accident investigations to determine their cause and submit suggestions for future prevention.

Here is a suggestion which follows which is very important for you who join this campaign competing for the national safety trophy.

I wish to say right here in that connection that when we joined the Portland Cement Association trophy club, not then so called, there was one thing that helped to cut down our lost time more than all other things we did. We had a number of men who were not maligners but they made a slight accident injury the excuse for laying off for a while. When squirrel hunting time came, the quail season opened, or the early fishing season, what was the result? Lost time accidents, slight bumps, two or three days off. That gave him a day to hunt.

That wouldn't do; we couldn't make any record that way. We instructed the men that they could always, or nearly always, have off a day or two, if they could be spared, to go fishing or to go hunting just as long as they didn't all ask to go quail hunting the first day. We couldn't afford to shut the plant down for that.

In another particular instance, the visiting committee called on the supposedly injured workman who failed to report the following day. He had gotten a rather severe bump on his limb somewhat. They found him lying on his back under his automobile fixing the machine. If we had not investigated that it would have gone as a lost time accident. When the visiting committee asked him concerning the injury he said, "I am not hurt." I just wanted to fix this automobile.

"Why didn't you report yesterday when you got the bump?"

"Oh, I'm all right, perfectly all right."

The investigating committee eliminated that day from the lost time accidents. There were a number just like that.

(c) A visiting committee of employees, whose duty it should be to visit the injured employee to

counter-influence the tendency to malinger. Unwarranted lost time caused by malingerers operates seriously against the work of the general committee. However, they must not be the judge and jury of the man's ability to return to work. Let a competent doctor be that.

To keep the safety committee interested, furnish them food for thought, supplied from outside your own organization. I would highly recommend a membership in the National Safety Council. Secure the *National Safety News* published by the Council and the safety bulletins furnished by it. Send at least one or more of your foreman and if possible one or more of the leaders among your men to a meeting of the Congress, but be sure to attend at least one Congress yourself. You will want to go again. Join the safety campaign in your own industry and cooperate fully with the committee in your own industry and cooperate fully with the committee in the matter of collecting accident statistics. Only in this manner will the industry be enabled to compile the information that will eventually furnish the principle stimulus to those who do not believe in organized accident prevention work. Let me suggest that you read, if you have not already done so, the splendid paper read by the President of your Association at the meeting of the National Safety Congress in Chicago last fall.

In this connection I am sure you will pardon me if I refer to the splendid work of the American Portland Cement Association as indicating what the entire industry can do in the matter of stimulating accident prevention. As the result of a study of the accidents occurring in many of the cement plants in this country, the accident prevention committee of the Association prevailed upon the officers of the Association to award annually a suitable trophy to a plant operating the full calendar year with the least number of time lost accidents per 100,000 man hour exposure. The friendly rivalry thus stimulated enlisted the support of individual plant managements and the officers and directing managements of these plants, which instituted an accident prevention campaign in the industry that will be continuous. Accident prevention records that were considered splendid yielded to better records. The lost time was reduced from scores and hundreds of days per 100,000 man hours to two and three days per 100,000 man hours and even fractions of a day, and finally to the perfect record of no time lost accident throughout the year.

Again the skeptics would not believe; such a record could not fairly be possibly. The plants must be full of injured men hobbling on crutches, but the record was duplicated and then it was duplicated again, and as a result of the accident prevention work in many of the plants where the management has taken the lead and requires of its foremen the protection of the men and the supervision of their practices quite as much or even more than the supervision of the operation of their machines, there has been such a reduction in personal injury accidents that ten individual plants, eight in the United States and two in Canada, have just closed the year 1927 without a single lost time accident.

What is the lesson for other industries, especially your crushed stone industry, which in its nature is so similar to the cement industry? If the program adopted by the officers of your organization receives from your membership the support which it should you will soon establish an equally good or better record in your own industry, and where some of you lead I am sure the rest will follow.

Accident prevention efforts are in a sense remedial legislation, which always comes along after the development of the condition which it is the intent or purpose to correct. We might feel just now that the demand for some is so great that we might forego for a time the more intensive work in our own operations and devote that time and effort to a greater need and seemingly a more imperative demand, but I should advise that we stick to our bush where there is still lots of picking, for I am convinced that the greatest contribution that industry can make towards safety lies in the development of safe practice habits among the workmen, which can be accomplished only after persistent accident work. This will put the safeguard on the workmen, which is his chief protection, whether in the industry in which he is employed, the home where he exercises his chief influence, or on the highways of traffic.

Formation of Peat

In the course of a study of the formation of peat being conducted by the United States Bureau of Mines, Department of Commerce, samples of peat have been collected at various depths in Wisconsin peat bogs and are being analyzed to determine the rate of decay of various vegetable constituents such as woody matter and cellulose. The main question to be decided is whether wood (lignin) or cellulose, the principal constituents of plants, decay completely in the process of peat formation. If either decays completely, leaving no solid composition products, it can be concluded that the other is the original substance from which coal was formed. It is generally conceded that coal was formed from peat. Since the action of bacteria plays an important part in the decay of vegetable matter, a thorough investigation of this phase is now being made. It has been found that bacteria exist at all depths in the peat bogs but they are probably more or less dormant in the lower levels. It has been found further that where bacteria have become dormant their activity is quickly resumed when supplied with available nitrogen.

STABILITY OF CEMENTS IN CORROSIVE WATERS

By Dr. Haegermann, Karlshorst*

WITH regard to substances having an injurious action upon concrete and the different kinds of cement it can be stated that all acids destroy concrete and all kinds of cement, all bases are without action, while salts are in part non-injurious, in part injurious. It is only water-soluble inorganic salts which may exert a destructive action; sulphates such as those of calcium, magnesium, sodium, potassium and ammonium; chlorides, such as those of magnesium and ammonium can be mentioned as examples of salts exerting a particularly destructive action. A solution of a single salt often exerts a stronger action than a solution of several salts. Practically all natural waters constitute solutions of several salts. But it is also possible for a practically chemically pure water to exert a corrosive action on concrete when allowed to permeate it continually. A dense concrete and in addition a protective coating offers security.

The greater part of natural waters, however, contain only small amounts of injurious substances. In any case, however, a chemical laboratory examination of the water is advisable before the commencement of a construction. Of the different kinds of cements, some are stable in solutions while others, again, are attacked. Thus, for example, according to the experience up to the present, fused aluminous cement is stable in a magnesium sulphate solution while all the other kinds of cement are destroyed in it; in waters containing calcium sulphate fused aluminous cement and also ore cement have shown themselves to be resistant. According to observations up to the present, fused aluminous cement and ore cement are stable in salt water while the other kinds of cements in this case are stable only under certain conditions.

In the case of the solution of a salt it has customarily been observed that when one kind of cement is destroyed the others also are not resistant for any length of time. This refers to typical cements: Portland, Iron-Portland and Blast Furnace Cement. In circles of cement consumers there has been drawn from this the conclusion that it must be idle to speak of a "better resistance" with regard to the behavior of cements in corrosive waters, inasmuch as the cement will either fulfill its purpose, the concrete remaining stable, or it will not, the concrete being destroyed. In the latter case where protective measures are necessary it is a matter of indifference what kind of cement be used.

This objection is not entirely unwarranted. As a matter of comparison the permeability of concrete to water can be cited. The house owner who demands a dry cellar would receive but little satisfaction from the showing of the "superior" density of a concrete by the water in the cellar attaining ground water level in four weeks instead of in one or two weeks. In this case there is only a consideration of water-proof or non-water-proof concrete; varying degrees of resistance to penetration by water of a concrete in itself non-waterproof can be differentiated but this is of no value to the practical user.

Returning to the question of stability of concrete in corrosive waters, here, again, the only matter of interest to the practical user is a guarantee of continued absolute stability, not a graduated one, better or worse. It is a matter of no import to him that a construction is destroyed only after four years instead of in two years. There are some practical users, however, who take the position that it is preferable that destructive action set in in a comparatively short space of time so that when it becomes apparent the necessary protective measures can be taken to prevent further destruction. The "superior" behavior of individual cements such as has been fixed by experiments covering a comparatively short space of time such as two or three years, has in itself no practical significance.

With regard to the question of resistance and non-resistance a few examples are given. Both have been made in the proportion of 1 to 3 pit sand and have been kept for ten years in a saturated calcium sulphate solution. White the trial briquette of Portland cement has become only slightly pitted in this space of time this is of no import with regard to its durability as in the course of time it would be destroyed. The experimental briquettes out of special blast furnace cement were stable after being kept for 18 months in solutions of sodium and magnesium sulphate respectively, after an exposure of several years they showed scaling. Finally, there is this instance of a case where the corrosive carbonic acid was the destructive agent:

In the construction of a coffer dam the enclosing walls were constructed with blast furnace cement and bottom water had permeated through the originally dried out bottom pit. In itself the penetration of the bottom water was insignificant but it contained 24.5 milligrams of corrosive carbonic acid and the result was that the blast furnace cement (similarly to all cements) was dissolved out of the concrete. Even in a short time a thick yellowish slime had settled in the construction pit which had the following composition:

*Translated by Universal Trade Press Syndicate.

Insoluble Matter (Sand)	5.50%
SiO_2	4.16%
Al_2O_3	0.54%
Fe_2O_3	2.14%
CaO	41.16%
MgO	4.90%
SO_3	0.20%
Sulphide S	0.14%
Loss on Ignition	38.51%
Residue	0.75%

The upper portions of the slime were richer in alumina.

On account of the short space of time in which the signs of destruction became evident the cause could quickly be ascertained and the necessary measures of protection taken for the preservation of the structure.

If it is a fact that all kinds of cement are destroyed slowly or rapidly by a solution, then it is a matter of indifference what kind of cement be used in making the concrete which comes in contact with this solution; the choice of a protective agent is of importance, as care must be taken that the solution be kept from contact with the mortar or concrete.

A special place among natural waters is occupied by those in which a mortar or concrete made from the same cement can be either permanent or suffer destruction. To this class of waters which with reference to their action can be designated as border waters belong salt water and certain river waters which hold in solution several salts; also slightly acid swamp waters. In the case of border waters the density of the concrete is in many cases the decisive factor with regard to stability. Michaelis at one time said "With the possibility of penetration by solvents decomposition will undeniably commence." This statement can be confirmed by many examples in practice. Reference can be made to the behavior of mortar made from the same cement which was used in harbor constructions in Dunkirk and in Boulogne. In Dunkirk where a very fine (accordingly poor) sand was used the cement did not stand up, in Boulogne on the contrary where a good sand was chosen it has not been possible to note any deterioration after a period of observation of more than twenty years.

Though density in concrete in the case of salt water may be of a preëminent importance, it is, however, not an exclusively decisive factor. Also in the case of dense mixtures, consideration must be given to the cement; it has been observed one cement of a given type may be stable, another cement of the same type unstable.

From the experiments carried out by the Staatlichen Material-prüfungsamt and by the German Portland Cement Manufacturers' Association, a research work which undeniably belongs to the most extensive and most important in this line, Gary has drawn the following conclusions:*

"In order to attain resistant construction in sea water it is necessary to use a cement as rich as possible in silicic acid but low in alumina and oxide of iron. The value of such cements when at the same time they are rich in lime can be increased for sea construction by the addition of trass. The use of as rich as possible mixtures impermeable by salt water, is, however, a decisive factor in permanency of construction, as well as adequate and sufficient hardening of the structure by heat and in moist air before it is allowed to come in contact with the salt water. Concrete the mortar of which contains more than two-thirds of sand per volume, as a rule will not have sufficient density to offer resistance to the destructive action of salt water for any length of time."

Grassner,* as the result of a very careful scrutiny of the literature on this question, has come to the following conclusion with regard to the properties of the cements:

"Among the Portland cements, blast furnace cements and Iron Portland cements understood as such, none of these cements unconditionally take a position of preference with reference to the question of being salt water proof, the whole matter depends solely upon the selection of suitable brands of manufacture. Failures are less likely to occur in the use of tested special cements amongst which ore cement especially offers a higher degree of safety than the special blast furnace cements depending upon accidental conditions in production."

With regard to Portland cements so far as the composition goes, on the basis of earlier observations, which, however, still require a reexamination, the following indications may be set up:

(1) Portland cements with a high silicic acid content (about 23 per cent and more), low alumina and oxide of iron content, with a hydraulic modulus up to about 2.15 furnish a concrete stable to salt water when used with suitable aggregate and proper handling.

(2) Portland cements with high oxide of iron and low (about 2 to 4 per cent) alumina content and a middling silicic acid content as exemplified by ore cement, are resistant to salt water.

(3) Portland cements with a middling content of hydraulic factors should have a hydraulic modulus of not over 2.0. In case of a higher hydraulic modulus the addition of trass to the aggregate is recommended.

(4) Portland cements with a high alumina content (about 8 to 9 per cent) and a low silicic acid content are stable when they are worked with trass which must be calculated as aggregate and not as cement substitute.

Good sharp burning is a prime requisite for all cements. The claim that cements rich in lime are more durable than those poor in lime does not hold

*Contribution from the Staatl. Mat.—Prüfamt 1919, page 170.
*Praktische Sonderfragen bezüglish Betonbauten im Meerwasser. Zementverlag, Charlottenburg.

good in this general sense. This referred originally only to the lime content in Portland cements rich in alumina and was later applied to different kinds of cements. Cements rich in lime can possess greater resistance to salt and swamp waters than those poor in lime. Thus ore cement which belongs to the class of cements rich in lime has made good in salt water, something which can not be claimed for all cements belonging to the class poor in lime.

Dr. Grün* has observed that high grade Portland cement is more resistant in different salt solutions than ordinary Portland cement. While the analysis of the cement in this case was not available, high grade Portland cements generally have a higher lime content than the ordinary kinds.

According to Rudolph Dyckerhoff a Portland cement rich in lime and silicic acid and low in alumina is more resistant than one poor in lime and silicic acid and rich in alumina.

Special methods for the testing of cements intended for use in salt water structures are much to be desired, their formulation in the first place requires the most exact knowledge of the influence of the composition on the stability to salt water. The specifications must, above all, bear on the composition of the cement and on the intensity of the burning. In order to provide a complete scheme indications with regard to the nature of the aggregate and the working of the concrete are called for.

In conclusion it may be said, that, in a practical sense, only the absolute and not the relative stability in salt water constitutes a standard. In the case of border waters, such as for example ocean water, density and after-treatment are of essential value.

Portland cements with a high silicic acid or a high iron oxide content but with a low alumina content give even when relatively rich in lime, stable cements; Portland cements with an average silicic acid, alumina and oxide of iron content should have a hydraulic modulus of not over 2.0, while Portland cements with a high alumina content (8 to 9 per cent) are advantageously worked together with trass. The degree of the lime content alone is no criterion for a valuation.

*Address before the International Congress for the Testing of Technical Materials, Amsterdam, 1927.

Service Is the Finest

B. G. Lucas of the Valley Sand and Gravel Corporation, Canawaugus, N. Y., comments on PIT AND QUARRY as follows: "I certainly enjoy reading your magazine and your service to subscribers on equipment advertised is of the finest."

Crazing and the Growth of Hair Cracks*

Hair cracks or crazes may be the result of a blow or other mechanical cause, but more frequently they are caused by unequal expansion and contraction of the surface and the main body. Heat and temperature are contributing causes but the chief cause lies in variation of the moisture content of the hydrated cement. In the usual case of pavements and stuccos, they are caused by too rapidly drying the upper surfaces. If the drying continues, after the crazes are formed, and the mass comes to a uniform moisture content, the strain is relieved and the shrinkage cracks usually close. If exposed to water, working from the upper surface the upper layers will expand and the cracks will close and remain closed until the mass dries from the top, when the cracks will open and penetrate more deeply, into the structure. There is some evidence that cracks forming in the interior mass may repair themselves, which does not happen to cracks originating at the surface because the carbon dioxide of the air reacts with the hydrated lime and forms crystalline calcium carbide on the fresh surface.

Crazing may be prevented by using a lean mixture. It has two advantages, there is less colloidal cement to cause shrinkage and the absorption of water through a lean mixture is much more rapid than through a rich mixture as the whole mass of a lean mixture expands and contracts more as a unit. A lean mixture may be so porous that the water freezing in the pores will cause disintegration. Protective coatings and water proofings of the water repellent type are helpful but care must be taken, when using the waterproofings, to keep the concrete damp until adequate shrinkage is obtained for after waterproofed material becomes dry, it absorbs water slowly.

*Abstract of a paper presented before the American Concrete Institute, Philadelphia, February 28-March 1, 1928, by White, Aagard and Christensen.

Improvement in Agriculture Expected

Some improvement in agriculture is expected for 1928 if farmers avoid expansion of production and continue their efforts to balance production with demand, according to the annual agricultural outlook report for 1928 prepared by the Bureau of Agricultural Economics of the United States Department of Agriculture.

This report presents conditions for the country as a whole and will be supplemented by many State and regional reports prepared by the agricultural colleges and extension agencies in the States to aid farmers in planning their operations for the crop year 1928.

Lots of Useful Information

Mr. J. H. Clark, Ringgold, Georgia, writes as follows: "I now find lots of useful information in your Pit and Quarry."

OUR NATIONAL SAFETY CONTESTS

By W. W. Adams,
Statistician, Bureau of Mines*

THE United States Bureau of Mines, shortly after its organization in 1910, began the collection of accident statistics from all mines and quarries in the United States receiving annual reports from all producing companies so far as we could obtain the names of those producing companies.

We began the collection of accident data for quarries for the year 1911 and now have a continuous record covering accidents at quarries covering sixteen years. Those records are based upon more or less general compilations of the accidents that occur at the various quarry plants and do not furnish details regarding the surrounding circumstances of each accident separately.

After continuing that work for a number of years, and after safety work had advanced in the United States to quite a degree, it was found that more detailed information regarding accidents was necessary to supplement these more or less general annual reports which the Bureau receives from the operators. So about 1923 we corresponded with a number of the larger producers and obtained their cooperation in receiving more detailed information on accidents that occur at the plants. We continued to receive those reports from these few Companies through 1923 and 1924. They furnished a great deal of information to the Bureau's engineers because each accident was reported to us quite in detail, but there was no assurance at all that each company was reporting all of its accidents and, as you know, unless you receive complete reports you have no basis on which to judge the frequency or the severity in relation to the amount of exposure to accidents.

About this time Mr. Greensfelder, on one of his visits to the Bureau, suggested that it might be well to interest the quarry companies in safety work by giving a prize for success in accident prevention. To make a long story short, plans were laid then for inaugurating the national safety competition of which you have heard during the past two or three years. The first year this contest was conducted was 1925 and for that year there were about 300 mines and quarries that enrolled as participants in that accident prevention effort. Not all of them succeeded in remaining in the contest throughout the year for one reason or another and some had to drop out. Perhaps some had very serious accidents in the early part of the work and thought it wasn't worth while to continue because they had no chance to win first place. At the end of the year we found that out of about 300 entrants there were 210 that completed the contest. There were a few over 200 plants in it next year, mines and quarries, coal mines, metal mines and quarries, and 257 of these plants succeeded in completing the year's contest, 47 more than in the previous year.

The third year of the contest, 1927, has just closed and we are now busy completing the records for the companies that were in that year's contest. The particulars regarding these accident reports are simple. When a company decided to take part in the national safety competition it merely agrees to give the Bureau of Mines a copy of each accident report covering lost time accidents. Some companies desire to use accident report forms which the Bureau of Mines gladly furnishes, but the majority find it more convenient to make an extra carbon copy of the report which the state law already requires them to send to the industrial accident commission or in the case of self insurers copies of the reports which they make to their insurance department.

At the end of each year each company is confidentially advised by letter as to its accident rates and how it ranked with all of the other companies. All of these accident reports which the Bureau of Mines receives are confidential. No company knows what another company is doing except by seeing that other company's accident rates published opposite a code number. The identity of the company is not revealed except to the company itself.

The companies are judged according to their accidents of varied grades, which means the number of days lost from accidents, or rather the number of days of disability resulting from accidents in proportion to the exposure. The number of man hours of exposure at a plant and the method of rating deaths and permanent disability is the method approved by the Association of Industrial Accident Boards and Commissions.

In 1925 the accidents of varied duration of quarry producers in the national safety competition ranged all the way from zero to sixty-five per thousand man hours of exposure. The average was 7.6. The next year the average was 7.8, and the range was from zero to ninety-nine.

One interesting fact that these records revealed was that the vast majority of the quarry companies had good accident rates. Taking the average for the group as a basis we found that eighty-two per cent of the individual plants had accident severity rates that were better than that average and only eighteen had rates worse than the average which indicates, of course, that most of the companies having reasonable safe plants are doing good accident prevention work.

*Presented before the National Crushed Stone Association January 18, 1928.

In the first year's contest, that for 1925, the quarry that won first place was the Security Limestone Quarry at Security, Maryland. It was operated by the North American Cement Corporation. The next year, 1926, the same company won first place but not for the same plant. The Sentinel's Trophy is the name of the trophy awarded to the winner in these contests, and that trophy was presented with appropriate exercises at the plant just last fall.

You may be interested, as members of the National Crushed Stone Association, to know that one of the other quarry associations, the National Portland Cement Association, has been entered in this contest since it began. The secretary of that association enrolled all the association plants that were eligible en masse. He did that the first year and he did it again the second and third years. Doubtless the Portland Cement Association will be well represented in that contest each year.

Sometime ago Mr. Graves, the President of your Association, asked me how many members of this Association were in the national safety contest: I told him there were thirty-eight quarries. He found that they represented only twenty-seven per cent of the membership of the National Crushed Stone Association. There has been a little increase in the registration for 1927, the year for which we are now closing the records but there should be more. There are forty-nine. Mr. Graves and Mr. Boyd are extremely anxious that the Association be well represented in 1928 in the competition which is now being started.

Just a comparison of two or three figures for your information, and not by way of drawing unfavorable comparisons at all. The Portland Cement Association members enrolled in the national safety contest of 1925 had an accident severity rate of 4.7. The National Crushed Stone Association members, in the same year, had a severity rate of 6.7. You were a little higher in the accident rate than the Portland Cement Association's companies but you reversed that comparison the next year. The Portland Cement Association accident severity rate in 1926, and this relates just to the companies in this contest and only to the quarry in operation and does not relate to the manufacture of cement, was 8.2. The rate of the National Crushed Stone Association members in the contest was 6.0.

In the accident frequency rate the comparison between the members of the two associations is a little bit more in favor of the Portland Cement Association. The frequency rate of the Portland Cement members in the first year's contest was 25, and the National Crushed Stone rate was 61. The next year's Portland Cement rate was 24, almost the same as it was the year before, and the National Crushed Stone Association members' rate was 41. You see the rate for the Crushed Stone producers is considerably higher than the rate for quarries operated by the Portland Cement Association. Nevertheless, I should like to call your attention to the great reduction which the Crushed Stone people made in their accident frequency rate in the two years. The first year it was 61. That means 61 accidents of all kinds, fatal, permanent, temporary, accidents involving loss of time beyond the day on which the accident occurred. The frequency rate per 1,000,000 hours was 61 for the National Crushed Stone members and 41 the next year. We don't know yet what it will be as a result of the 1927 contest because all of the records are not in yet.

Mr. Boyd and Mr. Greensfelder thought there should be some recognition, and many of the rest of us agreed with them heartily, for good work in accident prevention among the members of the National Crushed Stone Association and through the courtesy of Mr. Greensfelder a trophy was provided to be presented to the member of this Association that made the best accident record in 1926. Honorable mention was given to the two other companies that were next best. I don't suppose, Mr. Greensfelder, that I will be presuming to announce the names of the members even though you are going to present the trophies tonight.

The first place for the best accident record of the members of the National Crushed Stone Association was awarded to the Louisville Cement Company at its cement rock quarry at Speed, Indiana. That company operated the whole year with no lost time accidents at all. The France Stone Company at their limestone quarry at Monroe, Michigan, received first honorable mention, and the limestone quarry of the Wickwire Spencer Steel Company at Gasport, New York, received honorable mention ranking third among the members of the National Crushed Stone Association that were enrolled in the contest.

President Graves and Secretary Boyd are extremely anxious that this Association's membership shall be represented by a larger number of companies. You may be interested in knowing which members of the Association are already enrolled. Our records for 1927, the year just past, show the following among those that have participated in this work:

American Limestone Company.
Bessemer Limestone & Cement Company.
Brownell Improvement Company.
Duluth Crushed Stone Company.
John T. Dyer Quarry Company.
Erie Stone Company.
France Stone Company.
The France Company.
The France Limestone Company.
The France Quarries Company.
General Crushed Stone.
Charles O. Hunsicker.
Lake Erie Limestone Company.
Liberty Lime & Stone Company.

Linwood Cement Company.
Louisville Cement Company.
Mid-West Crushed Stone Company.
Ohio & Indiana Stone Company.
Rock-Cut Stone Company.
The Toledo Stone & Glass Sand Company.
Universal Granite Quarries Company.
Whiterock Quarries.
Wickwire Spencer Steel Corporation.

The Bureau of Mines is willing to handle the accident records for as many companies of the National Crushed Stone Association as decide to enroll in the 1928 contest or, I should say, as many companies as decide to enroll in the Association's contest which is linked up with the national safety competition.

It was necessary to formulate rules governing the national safety competition and the employment of twenty-five men inside of the quarry pit was made the basis of eligibility. Companies having less than twenty-five men inside the quarry are not eligible to take part in the national safety competition. But they are eligible to take part in the contest so far as it relates to the National Crushed Stone Association. So I repeat that the Bureau of Mines will be very glad, indeed, to keep the accident records of all the Association's members that care to compete for the Association's trophy. You will see that trophy at the banquet tonight.

The quarry industry suffers about 13,000 lost time accidents each year. Many companies operate during the whole year with no accidents at all, and perhaps it is difficult for those companies to see the importance of joining in a movement of this kind. But let me suggest to you that many companies that have one, two and three accidents in a year contribute to a total that is quite considerable. Incidentally, also, those companies that have no accidents at all would help to make a favorable showing for the industry if they would participate in accident prevention contests of this kind merely by reporting their man hours of exposure because, as you know, it is the man hours of exposure that is used to determine the accident rate, and your accident rates for the industry as a whole or any large section of it are used as a basis for calculating the base rates of the insurance premium that you pay.

There can be no doubt that these insurance premiums which any industry pays are adequate. That is, they are sufficiently high, and as long as the insurance carrier does not go into bankruptcy you can be sure that the insurance rates are high enough.

One would think that each industry would owe it to itself to lay a foundation for arguing for reduced rates if it is entitled to reduced rates, lay a foundation that would be beyond dispute, exact accident records for such a foundation particularly when those records are based on large and representative groups of any given industry.

Business Ailment Is Overproduction Claims Alvin E. Dodd

Ailments from which American business is suffering were diagnosed as "indigestion amounting almost to dyspepsia," by Alvin E. Dodd, manager of the department of domestic distribution to the Chamber of Commerce of the United States, in an address February 22 before the National Battery Manufacturers' Association. "The impetus given production during the war has resulted in the turning out of commodities more rapidly than we have learned to absorb them," he declared. "The digestive apparatus of business and distribution has become more or less disorganized and must be readjusted and synchronized to mass output before order is restored."

Concretes

The quantity of stone to be mixed with a given quantity of water is determined from the volume of voids. In making the mortar, the interstices in the sand are taken into account and cement and water are used sufficient in quantity to fill such interstices and provide an excess sufficient for workability. Similarly, with regard to the stone, the voids are determined and to a fixed quantity of mortar, a quantity of stone is apportioned such that the voids will be filled and a workable excess of mortar allowed. From samples of the stone, the specific gravity and the maximum percentage of voids likely to occur may be determined, and thence the smallest volume of stone that may be used with a batch of mortar is calculated. The weight of this volume is then taken, and compared with the weights of similar volumes of actual quantities to be mixed. The voids in these quantities may then be determined, and the total volume of stone to be used with the batch of mortar adjusted. Charts or schedules have been prepared indicating the amount of stone to be added according to the weight of the standard volume of stone.—A. E. White (British Patent 281,138).

Loss on Burning of Cements

The estimation of the loss on burning of cements requires inclusion of several precautions. Cements which contain blast furnace slag, during calcination in the oxidizing atmosphere of the furnace increase in weight due to the partial transformation of the calcium sulphide content to calcium sulphate. On the other hand, a source of error common to all cements, is the absorption of carbon the reducing gases from which partially reduce calcium sulphate to the sulphide. A partial reduction of ferric to ferrous oxides may also occur. Also, the results are influenced by cracks in the furnace, the setting of the crucibles and similar factors.

HOW CAN WE MORE EFFECTIVELY SUPPORT CAMPAIGNS FOR PUBLIC IMPROVEMENTS?

By C. D. Franks*

THE spectacle of the American citizen as he goes to vote is seldom inspirational. I am speaking of the average man, the man whose voting franchise, for good or ill, determines the destiny of our nation. He's a good fellow, amiable, a good husband, a fond father and all that sort of thing. But see him as he goes to vote.

At the corner half a dozen partisans of as many different candidates thrust handbills at him. He walks the next hundred feet idly considering the names and faces of a lot of beaming candidates who, although utter strangers, have suddenly developed a tenderly solicitious enthusiasm for him. He enters the polling place, stuffs the dodgers into his pockets, gets his ballot and retires into the sacred calm of the voting booth.

"Now," says he, "I shall vote. My father was a Republican and the Democratic candidate's name is Percival. I shall vote Republican. So much for that."

He goes down the ballot, dispassionately distributing the favor of his patronage. And then he frowns, for he has come to the section on bond issues for public improvements. His instincts for businesslike procedure impel him to read at least a part of the text describing the first proposed improvement but it's tough going. The men who do that sort of writing are seldom entertaining writers. At any rate by the time he has discovered that the improvement is to be a large one, running into many millions of dollars, his pocketbook begins to talk to him.

"Fifty millions, eh? Sounds like graft. What would I do with fifty million! Boy! That insurance premium's due next month. The kid's got to be educated and Helen's raising Ned for a new rug. Nope, nothing doing. Can't afford it."

And he scrawls a lusty black cross in the "NO" box.

We understand perfectly his reasoning. We sympathize with him. But we also realize that this amiable gentleman and his millions of brothers throughout the country are victims of ignorance and indifference which, unless they be eliminated, may serve to block the material progress of the land.

Most of us here today are acutely interested in public improvement projects. For one thing, we honestly believe in the value to the public at large of these improvements. And, in the second place, we have allied ourselves, in a business way, with the means for providing these improvements.

How are we to transmit our enthusiasm and our knowledge to the average citizen so that, when the crucial moment comes in the voting booth, he will not permit temporary, personal and relatively unimportant factors to mould his judgment?

Every successful bond issue has contributed to our fund of knowledge on this subject, but, while methods vary from place to place and time to time, there is one dominant principle which must be observed. It is simply this: get the facts to the average man.

I do not discount appeals to the voters' community, loyalty and pride; I do not object to more or less elaborate ballyhoo, but unless facts receive the major emphasis, the campaign may fail, or, and worse, result in a wave of public reaction against all improvements which may handicap the community for a long time.

Once a man knows something about anything, no matter what, he becomes interested in it. And that personal interest will serve amply to over-ride petty prejudices or indifference. Take, for example, a bond issue for certain highway improvements. Our friend, the average citizen, should know and be able to visualize (1) where the road or roads are to be located, (2) the immediately resulting benefits to his own community, (3) the type of road to be built, (4) the inadequacy of the present roads, and (5) the effect of the improvement on his own personal well-being and expenses.

There are, of course, many other points which must be dwelt upon in the course of the campaign, but it is wise to remember that any man, any one of us, is an essentially self-centering being. We may not be selfish in the ordinary sense of the word, but our judgment is inevitably influenced by what we feel will benefit or damage our own lives and the lives of our family and friends.

With this in mind, then, let us consider the work of the campaign, assuming, of course, that the soundness of the proposed improvement, from both economic and engineering points of view, has been well established.

The type of organization to be built up depends, naturally, on the scope of the project. But in any case there will need to be a well identified center of authority and information, a series of district captains, subdistrict leaders, and finally, local workers.

Naturally, I am most familiar with campaigns organized to promote hard roads bond issues. One of the most complete and effective of such organizations was that which carried to a successful culmination the campaign for good roads in Mis-

*Presented Before the National Crushed Stone Association, January 19, 1928.

souri, a few years ago. In this instance the Missouri Statewide Good Roads Association joined forces with the State Highway Commission. Directly responsible to the executive committee of the association were committees on publicity, speakers, finance, entertainment, transportation and work at the polls. Working out from the executive committee were two state chairmen one for the men's organization and one for the women's, each of whom directed the energies of division chairmen, county managers, county district managers and subdistrict workers. While this type of organization may seem complex, it must be remembered that the job to be done required intensive and far-reaching work. The men in isolated farming sections had to be interested; women in out-of-the-way villages had to be made to feel that the statewide highway project was of prime importance to them. Informal, word-of-mouth "advertising" is still the most effective means of influencing anyone, hence the careful follow through the effort down to the subdistrict workers.

In less than state-wide projects it is possible, and often advisable, to use simpler organizations. It has been said that we Americans have a genius for organization. That is true enough, but we are likewise tempted to let our genius for organization load us down with top-heavy, bulky machinery which is often more decorative than efficient. Overhead and operating expenses have ruined many a beautifully organized business.

In any campaign looking toward a bond issue there must be a division of labor and responsibility. Somebody must be responsible for raising funds to carry on the promotive work; someone else must focus and direct the advertising work, whether by word of mouth or by any other medium, and there must be someone else to coordinate all the work that is done.

Granted that we have an organization capable of functioning without friction, the next step is to get the committee on publicity to work. This committee is of the utmost importance. No business man needs to be told that publicity can make or break an enterprise. It is therefore essential to find publicity men who are intelligent, experienced and enterprising, men who can work with newspapers without antagonizing the editors. As a general rule, any really vital program of public improvement will receive the backing of newspapers without stint, but no editor will long cooperate with a publicity man who is more interested in grabbing free space than in providing a good, readable copy.

Publicity, as a fine art, is often scorned by the papers because it is so patently an attempt to get something for nothing, a bid for space with no legitimate news ingredient. But publicity can be and often is as interesting and as newsy as anything gathered by a paper's own staff. The successful publicity man is capable of putting honest news values into his stuff, and when he does that the editor will not only print it but welcome more.

Not all publicity need be in the news columns of the papers. Nicely timed, paid advertisements can do wonders in informing the public of the project. Likewise they aid materially in maintaining the happiest relations with the papers.

The ramifications of publicity enterprise may be endlessly extended. In every community there are trade papers, class publications and many other journals which the careful publicity department uses. News stories, written with their various special interests in mind, will almost invariably be found acceptable. Billboards, posters, slides for showing at motion picture theaters—these and many other forms of publicity will be found effective.

The committee on speakers can be important or not, depending on the care with which speakers are chosen and speaking dates made. It is not often that one man can be found who will appeal to several different types of audiences. For example, consider how difficult it would be to find a man who could present the cultural and social advantages of a good roads system to women's clubs, the commercial and financial aspects of those same roads to Rotary and Kiwanis clubs, the labor phase of the project to meetings of labor, and the economic significance to chambers of commerce. It might be done, but I do not envy such a man his job.

In the course of some campaigns it has been found expedient to give large and inspirational banquets. Any man who has ever arranged a banquet will be my authority for the statement that nothing is so easy to make as a dull banquet and nothing so hard to arrange as a lively, result-producing one. Mass-meetings present somewhat different problems. The prime essentials of such meetings are spread-eagle oratory, brass bands and a deliberate use of the principles of crowd psychology. Mob hysteria can be a bitterly cruel thing, heedless and insane; but properly guided to serve a legitimate cause it can be constructive and effective.

I am going somewhat into detail in order to provide a background for my remarks on the main theme which is—how can the industries which we represent effectively tie into the promotion of such a campaign?

For some twenty years, now, America has been a country of slogans. Some of our amiable critics have said that it is typical of us to get a catchy slogan, organize a company and then begin to deliver goods suggested by the slogan. Be that as it may, there can be no discounting the fact that a good slogan can be made a real asset in any enterprise, providing we master the slogan and do

not let it master us. A vivid slogan in connection with the promotion of public improvement projects can be of honest value. However, I suggest that we benefit by the experience of others and disregard flamboyant superlatives. I doubt that much is gained by claiming that any one improvement will bring in the millenium. Likewise make your slogans pertinent. I have in mind one good roads campaign slogan which was, in effect, "Podunk Forever." This was capable of interpretation in many ways and was doubtless an estimable sentiment, but it sold no roads.

As I have said, the major function of any promotion enterprise is to get the facts to the people. If the goal is roads, specify roads. If it is a dam, don't let it be confused with a new park system.

One of the most effective pieces of general promotion is the presentation of questions and answers on the subject of the proposed improvement. Shortly before one of Pennsylvania's bond issue polled, a pamphlet was broadcast containing a dozen questions together with definite answers to them on the proposal to issue $50,000,000 worth of good roads bonds. The questions ranged from such an elementary one as, "Why borrow money to build roads?" to more technical ones on federal aid and the influence of the bond issue on taxes. This device is a good one; it raises healthy doubts in the mind of the voter and then presents equally healthy but constructive answers. In other words, it is a means for presenting facts.

Speaking of doubts, every campaign must expect to meet a degree of opposition which may be healthy or otherwise, honest or dishonest. It is a well established fact that those who are opposed to any project are far more certain to go to the polls to vote than those who are either indifferent or even in favor of it. The opposition carries a grudge, as it were, and it's human nature to play a grudge to the limit.

In order to meet this situation, it is necessary to promote, along with the main idea of the campaign, a drive to get out the vote. If you can get to the polls the majority of the lukewarm and mildly interested people, they will vote on your side. But the job is in making them see that voting is necessary. Most of us have a "Let George Do It" complex and it's a very hard thing to kill.

In getting out the vote there are several avenues of approach. There is direct-by-mail appeal to thousands of substantial men whose standing in their communities indicate that, were they to vote at all, they would be on your side. Then there are the Kiwanis clubs, the Rotarians, the chamber of commerce, the ad clubs and the fraternal organizations, all of which are or can be highly influential in getting men and women to the polls. Display advertising of all kinds, whether in publications or in poster form, may well stress the word "Vote!" with its connotations of voting on the constructive side of the issue.

There are few industries which cannot be lined up to aid in the campaign. I do not mean by this that they should be expected to contribute financially; that is a factor which must be determined solely on the basis of taste and judgment in any locality. But I do mean that most business organizations will be found to be willing supporters of and workers in the campaign itself. Many of them will contribute, for example, a display advertisement in the newspapers, stressing the benefits to be gained by the project, and incidentally, presenting themselves in the light of forward-looking, progressive concerns. Likewise they can do effective work in presenting the facts of the situation to their employees and in encouraging them to vote.

Certain industries which are more or less intimately allied with the project will be found anxious to cooperate even more actively. For example, chains of filling stations have often cooperated with the publicity committees of good road campaigns by distributing leaflets and other literature. Similarly, automobile stickers have been handed to motorists by garage and filling station men.

Stores and banks, in some instances, contributed display window space. Cleverly designed models of the improvement itself invariably attract public attention and serve to vivify the project in the minds of those to whom the printed word is not exactly pictorial.

In any public improvement campaign the part of such businesses as are represented here depends largely on local conditions. In general, it may be said that the expert assistance you are equipped to give will be most appreciated. For instance, if you maintain a publicity department, offer its services freely. If you have any literature describing the part your product played in similar public improvements, adapt it to meet the local situation. Instruct your salesmen and field men to refer tactfully to the proposed work in all their contacting. I say "tactfully" because your self-interest in the project must be kept in the background.

In regard to campaign contributions there can be no definite, cut-and-dried procedure. Campaigns have to be financed and it is natural that those who will benefit directly or otherwise, in the realization of a campaign's goal may well be expected to participate in the money raising. However, as Messrs. Smith of Illinois and Vare of Pennsylvania can attest, there are dangers in campaign finances, no matter how altruistic one's motives may be. Every man must be his own judge in determining the extent to which he and his firm will participate.

It is a difficult subject, at best; one in which there are delicate balances and dangers. But this much can be said. The firm which contributes to any such fund and does so most frankly and with the fewest strings tied to its contribution will be the firm which profits most in the long run.

Every time a campaign is swung into action, there is something of the old Liberty Loan Drive spirit revived. All of you remember the frenzy of those days, days filled with the blare of massed bands, the full throated oratory of thousands of four-minute men and myriad other excitements. We cannot hope to recapture that fine, careless rapture. I am not at all sure we want to. Our purposes are far different, our times are of a different mood. With no real loss of love for our country we have become a little skeptical of highly emotional appeals. We may be swayed for the moment, but dangerous reaction sets in quickly.

However, we must have enthusiasm in promoting our public improvement campaigns, and we must have plenty of it. But we cannot expect to get anywhere on enthusiasm alone. The law of diminishing returns is never more active than in this matter of emotion. A certain degree of popular excitement may put over a project today, but to promote a similar project tomorrow we must work up a much more intense wave of emotion. And so on. There are no absolutels in the emotional appeal. But facts are facts, yesterday, today and tomorrow. Circumstances may change, but the basic facts remain. On them we must base our appeal to the mind of the public.

There is an ancient law of journalism which is drummed into the head of every student of that art early in his training. It is called the Law of the Five W's. It provides that early in every news story the five W's of Who, What, Where, When and Why if possible. Why shall be defined. If, in carrying on our campaigns, we send the voters to the polls fully informed on the W's of the proposition, we need not fear that the privacy of the voting booth will be but a protection for his ignorant prejudice and important indifference. (Applause.)

County Highway Financing

John J. McHugh

The various types of highway construction have each an agreed upon life or period of usefulness. It is certainly not good financing to attempt to borrow money or issue bonds for a longer period than the probable life of a particular highway.

Here is a schedule of the probable life of various types of highway construction which is working most satisfactorily in many of our counties: For construction and reconstruction of bridges, including retaining walls and bridges of stone, concrete or iron construction, or of a combination of any or all of these materials—thirty years.

For various types of highway construction as follows: Of sand and gravel, five years; water bound macadam or penetration process, ten years; blocks of any material or sheet asphalt laid on concrete foundation, 20 years; concrete construction not less than six inches thick, 20 years; for the acquisition of lands for highways or for eliminating curves or for grading, or for any or all of such purposes, 30 years; for construction of grades, sidewalks or gutters, of brick, stone or concrete, or for any or all such purposes, ten years.

Adopt a resolution, ordinance or other authorization providing for a sufficient appropriation of funds to meet the cost of the work, plus the necessary fees for engineering, inspection and other proper incidentals. Ordinarily such authority should be granted after the bids for the work have been received, but before the contract is awarded.

The appropriating resolution covers the legal necessity for having provided for funds. It should provide that the moneys required be raised by the issue of temporary bonds, or notes, to be issued from time to time as required, which will result in a considerable saving of interest when contrasted with the other plans of issuing the total amount of bonds or notes required all at one time.

When the total cost of the improvement has been ascertained, the permanent serial bonds are issued as under the serial plan, annual payments retire a certain number of bonds which automatically reduces the interest charge.

In determining the sale of the permanent bonds it has been found to be much more satisfactory to pay a slightly higher rate of interest because of the higher premium paid by the bond buyers. To provide against any misuse of such premium in advertising the sale of the bonds, notice should include the statement that the total amount of money necessary to be raised is $....., and that the bonds will be sold to the bidder offering to take the least number of bonds plus the greatest additional sum. So that this may be clear, we will say that the amount to be raised is $500,000.00 and that the bnods will be issued in multiples of $1000, and one bidder offers to take $470,000 of the bonds and pay therefor $500,000.99—the second bidder offers to take $471,000.00 of the bonds and pay therefore $500,999.99, obviously the first bid would be the highest and there should be a further proviso that the bonds to be delivered should be those first to mature. In the example just cited, the thirty bonds last to mature will be destroyed and the greatest amount of interest saved.

Bureau of Mines Films Have Wide Use

During the three-month period ending December 31, 1927, the educational motion-picture films of the United States Bureau of Mines were viewed by 309,354 persons. It is estimated that at least 1,250,000 people will view the films during the coming year. Details regarding the free exhibition of these films, which depict the methods of mining, treatment and utilization of the numerous essential minerals, may be obtained by addressing the Graphic Section, Pittsburgh Experiment Station, United States Bureau of Mines, Pittsburgh, Pa.

ABC's OF ACCIDENT PREVENTION

By R. P. Blake

Sales Engineer, Independence Bureau*

THERE isn't a man but knows, if he has thought about it at all, everything I am going to say. I am going to talk to you about these things because I think it is the way of being the most service to you. I am going to try, in a few minutes, to help you stand aside and watch the accident prevention movement go by, and take from that movement the outstanding message it has for each one of us. There isn't a thing in that that will be new to anyone, but they are all things that I think everyone should think harder about in order to do better accident prevention work.

Part of the reason why I am taking that attitude is that every man here must know a good deal about the safety game. Some of you are superlatively well informed and therefore I feel I can talk to you, present my ideas for frank discussion and frank criticism for whatever stimulation may be in them. That is my view of the service I can render.

As I make my attempt to stand off and watch the safety movement go by or get the broad, big features of it as one might do a mountain from a distance, the things I see are four: First, the extreme financial worth-whileness of the accident prevention movement, the extreme financial worth-whileness of effective accident work (I am not saying a word about the humanitarian effect). The second is the value of accident prevention work in building up the morale of an organization. The third big thing I see is that the causes of accidents are myriad.

As I go over the country I find, in talking to men in various lines of industry, what seems to me a popular misconception that ought to be killed. The fellows may be making some mental part, he may be a quarryman. Pretty soon he gets to talking about his special hazards in a way that shows me he thinks those special hazards are a good deal more important than they are. Mr. Adams could undoubtedly tell you, and anybody could tell you who had studied accident prevention from a record keeping standpoint, that the special hazards are in proportion to the whole hazards in any industry and that the overwhelming bulk of accidents are caused by accidents common to all industries. The thing I want to accent there is that accident causes in your industry, or mine, or any other, are myriad.

The fourth thing is that enough has been done, enough explicit accident prevention work has been done, enough organizations have run for longer periods without a lost time accident for it to be perfectly safe to say that anybody using good energy, common ordinary sense, getting after the accident prevention game good and hard will find his investment of money and time in accident prevention extremely profitable. In other words, it is entirely practical for any organization to reduce its accidents to the vanishing point with the ability and energy and money they already have in the organization.

To enlarge on these four things somewhat, of course at first in the accident prevention movement we merely saw the values of the direct medical cost and some of the indirect cost perhaps, and the compensation cost. Of course we saw the humanitarian appeal, but I am not talking about that today. As we went along and got more experience in accident prevention work we saw indirect costs, and they cropped up bigger and bigger until finally some little time ago—I believe a matter of a year or a year and one-half ago, two perhaps—the Travelers Insurance made a study and analysis of indirect costs of accidents, and did it very carefully. They came to the conclusion that indirect costs of accidents were normally an average of perhaps four and one-half times direct cost. Possibly my experience has been different from theirs, but from my experience, if I were to base it solely on my experience, I would say it is too low. It is perhaps ten times, and I could cite instances where a figure of twenty or thirty times the direct cost of accidents would be the figure you would want to take for the indirect company cost. It is many times the direct cost, and is altogether too big.

There is a reason for that. That reason is what I think is the best definition I ever heard for an accident. This definition defines an accident as anything that interferes with the orderly procedure of work. The reason for that is this: When you or anybody else undertakes to do anything presumably you plan it out as to how it is going to be done. If that is done with no interferences, no casualties, no injuries, there are no accidents. Therefore, if we are going to prevent all casualties, the thing to do is to prevent all interferences with the orderly procedure of the work and you have it. If we can just keep that ideal in our minds in all our safety work, I think we at no time will get very far off the best path for safety work.

That leads directly to another thought. Since everything that a man may do is hazardous in a greater or less sense, and since we are aiming to do the best kind of planning of all the work done as nearly as possible, we must follow the path in accident prevention work that leads to the minds of men. It is not through equipment but somehow

*Presented Before the National Crushed Stone Association January 18, 1928.

or other we have to give to every man in the organization, from the president of the company down to the least important laborer, the sense of working safety. He has got to develop a skill in working safely that enables him to do work that has to be done involving certain inherent hazards with the least probability of accident and do it effectively and quickly without too much loss of time.

That leads to my second point, the value of effective accident prevention work. Don't you see, if you can get all of the men in your organization to be one-minded on any particular thing, safety or anything else, anything connected with their work, they are going to be one-minded on all of the things that the management outlines to be done. They are going to function more smoothly, more effectively and the secondary result of your safety work is going to be a tremendous pulling up of the organization. I could talk for an hour, perhaps, giving you evidence to prove that, evidence given by men who have done, like Mr. Weitknecht here, notable work in safety, evidence that I have heard given, that I have read from their statements and speeches and published reports.

I am going to rest that side of it with one statement that was made by the late Judge Gary to the Board of Directors of the U. S. Steel Company reporting on the very large expenditures that corporation had made in safety work over a period of years. Among other things he said this, which struck me as being extremely forcible, and coming from the man it did who is extremely conservative, it is real. He said that the money and effort, particularly the money, expended by the United States Steel Corporation in improving the safety of working conditions has returned as big, if not bigger, dividends than any money the steel company has ever expended in any of its operations. I don't believe anybody could make it much stronger than that, and I don't believe anybody is better qualified to talk.

Coming back again to each man skilled in safety, I like to use this analogy of the person learning to dance. Take the ordinary person gifted with enough native ability who takes lessons and gets so he can take a few steps and can get around fairly well. He goes to a dance and as long as the floor isn't crowded and the music moves along smoothly he can go along fairly well if he has a rather tactful and able partner. But if the floor gets crowded, he is not adept enough to get around without bumping into somebody, and every time he does that he loses his step. That doesn't deter him. He takes more lessons. Presently he can make his way through any crowd without bumping and he always keeps step with the music. He perhaps learns to interpolate and put in little steps of his own. In other words, he has acquired a skill in dancing that he doesn't need to think about his step as he goes along. That is the sort of thing a man with his mind centered on one thing can get with sufficient attention and training. Just as the excellent dancer dances more and not any slower, so the worker skilled in safety doesn't do less work; he does more work and better work. He is the man his fellowmen like to work with and his employer likes to have him.

That is the thing we must give those men. Various people in talking on the safety movement have talked about the importance of the foreman. That is granted and is one of the A. B. C's. In getting to each man's mind, the foreman is the essential cog in the machinery, so I don't feel the need for talking much about that.

I am going to jump from the foreman to the chief executive. If the chief executive in the organization, particularly the executive in direct charge of your plant or organization, doesn't believe fully in the safety movement, doesn't believe fully in safety, and doesn't give it real push, it won't get anywhere. I am going to elucidate on that further.

This financial worth-whileness and the worth-whileness as a morale builder which produces further financial benefits comes through definitely establishing a safe plan and an effective one. You won't achieve one without the other. Mr. Weitknecht is going to talk later. I know very little about his company, the Lehigh Portland Cement Company, except to know that it is a large company in the cement game and that they have done some very notable work. I had the pleasure of meeting Mr. Weitknecht for the first time today. I know he has done some superlatively good work in the safety game in his plant. Without knowing a thing more about him and his company, I am willing to stand up and stake my reputation on one statement and that is this:

That if we had on that blackboard there the unit production costs of all the plants in the cement industry and were to compare the plants of the Lehigh Portland Cement Company with the rest of the industry their costs would be very high and be about in proportion to the kind of safety work they are doing as regards the other plants in the industry. Further, Mr. Weitknecht's plant, when you allow for difficulty in getting at it, would be, if not the best, one of the half dozen best in cost of the entire industry. The relation between cost and effective accident work is just that close. I don't believe anybody in the game anywhere can contradict my statement with any success.

Going off that for a moment to point number three, the myriad causes of accidents. Accidents can come from almost any old thing and the difference between a serious accident and non-serious accident, or no accident at all at times seems entirely infinitesimal. I can illustrate that better, I think, by telling an experience of my own at a time

when I was a manufacturing man operating with 500 men. We had a four-story building and it was roofed with ordinary slate shingle, a rather heavy, substantial piece of goods. That needed some repairs.

I had an outside contractor come in and repair that roof. I put in the contract a specification that he was to be very careful all the way through, and that when he left the job he was to clean up very thoroughly so there would be no loose material on the job. Shortly after he finished his job we had a very windy day. The next morning when I came to the plant the first thing I found on my desk was the report of two accidents, one a serious one. This man was coming to work on the eleven o'clock shift and had been hit on the head by a falling slate shingle and seriously injured.

The other report was of a man working at a bench in front of a window, and some falling object had broken the window and the flying glass had slightly cut the man working there. It was merely a matter of going to the first aid room.

I investigated and found a slate sticking edge up in the ground just outside of this window, and I found the window had been broken by this piece of falling slate. I went up on the roof and found four states stuck away in the corner under the eaves.

Where was the fault? That was an unusual sort of accident. At first glance I rather thought I could disclaim responsibility for it, but when I got to thinking about it I realized it was distinctly my fault because while I had foreseen the possibility I hadn't thought about it hard enough to make sure that the contractor was accurately checked up and had done everything he was supposed to have done.

Who would expect three slates to blow off? On the other hand, the potential power of killing was in each one of the falling slates and instead of having one man badly hurt I might have had three deaths.

The ways in which accidents may happen are myriad and are common to most everything taking the country over, and is undoubtedly true of your industry as well as every other. If you consider the accidents caused per year you will find up on the list slipping, tripping and falling. The only way you get away from them is by real care, real forethought, cultivating the safety sense, and so on.

My fourth point, the fact that practical freedom from disabling accidents is distinctly possible using the ordinary principles of good operation anywhere. I think if anyone setting out today to do this kind of accident prevention work who has an accident record, and wants to get the kind of a record Mr. Weitknecht has of running for a long period without a lost time accident, and some of those Mr. Adams told you about, I think if the chief executive who takes the decision and has the responsibility for that keeps four things clearly in his mind he won't go far wrong.

The four things he needs according to my ideas are these: He has to decide to apply intelligent, forceful executive direction to that problem just as he would on any other major problem of his operation, I don't care what it is. Second, he has to exercise everlasting care. Third, he has to maintain a fresh viewpoint. You know we all hit blind spots, and in the accident prevention game back of the blind spot lurks danger, and here is one of the big danger points in it all. If I am doing a certain thing and develop a blind spot and anybody comes along and makes a suggestion having to do with something behind that blind spot, I think his suggestion is absurd and won't follow it.

No matter how foolish a suggestion may appear, we have to cultivate the attitude of at least considering it with the mind open. If it is foolish, we have no right to assume it is at the start.

Just as a matter of illustration here is the Union Carbide and Carbon, Linde Air Products and others who have one of the most remarkable accident prevention records running over the past three years that was ever heard of. At the Sault plant at Sault Ste. Marie they make metal alloys, really quite hazardous work. They have run nearly three years without a lost time accident and other of their plants have run records of similar order. That kind of work extends through their whole organization.

Just to be sure that they get those blind spots wiped out as quickly as possible, just to be sure that they maintain unbiased and have as broad a viewpoint as possible they have, at stated intervals and sometimes at irregular intervals, the best outside engineers come in and go over their safety work, audit their plants. They go over everything in connection with safety with the greatest care, not because they think they can get any better but because they are going to use every possible means they can of keeping their own viewpoint fresh and clear and free from blind spots, and they consider that money very well spent.

An executive undertaking the work must maintain an alertness. I am going to tell a little story to illustrate that. There was a plant (I won't mention the name of it) manufacturing a heavy chemical. One of its raw materials was an asphaltic material which, as you know, is the residue from refining oil. This material came to them in tank cars and it was necessary to heat the tank cars with steam in order to get that material to flow out of the tank cars. Some of the time they had trouble and didn't get all of the material out and if they didn't get the material out they lost it.

They had men inspect the cars with care. Sometimes it was necessary to go into these cars at intervals. An outside engineer pointed out to those people that they were doing pretty good safety

work but that there was a matter of mild hazard because under certain conditions he was afraid an extra amount of volatiles might be left in the residual material and dangerous gases might be left in a car making it unsafe for men to go in it for inspection purposes.

It was pointed out to a number of others who frowned on it. They said, "We have done this work for years and have never lost any of our men through an accident of that kind."

The engineer persisted and said, "It is a fundamental practice. When it is necessary for a man to enter a car he must get in through a manhole. He should wear a safety belt in charge of a man outside and if he is overcome he can be drawn out and resuscitated." They paid no attention to him.

Some months later a car came in just of the nature this engineer feared might occur. There were two men in the tank car house working together. One man went through the manhole and into the car. The other man was on the ground paying little attention. Pretty soon the man who went into the car didn't come out. He made no noise and the fellow on the ground called to him. When he didn't get an answer he climbed on top, peered into the hole and saw him, then climbed in after him. He didn't come out. After quite a length of time had elapsed the foreman in the next building wanted these two men for something and sent a man after them. He couldn't find them anywhere around, so he climbed on the car and looked in. He saw the two men in there and climbed in when they didn't answer his calls. He didn't come out. After a while the foreman wondered why the men didn't report to him for work, decided he would find them. He looked all around and when he couldn't find any of them he climbed on the tank car and looked in. In a minute he knew what had happened and sounded the alarm. A man put on a gas helmet and went in the car in an effort to resuscitate them. Somehow during the effort to resuscitate those men and get them out the inflammable vapors in that car caught fire, exploded, and a fourth man was killed and any chance of resuscitating the three men in the car was lost all because a management failed to investigate a suggestion or take it to heart, a suggestion that seemed to them unwise but nevertheless was in accord with what had been proved elsewhere to be standard, sound practice.

In concluding I am going, in a very brief way, to try to bring all this down to what the National Crushed Stone Association may do. You have already heard Mr. Adams say what certain members of the Association have done and the excellent work they are doing. I know from figures from him, and figures elsewhere, that speaking generally there is tremendous room for improvement in the accident prevention work of members of the National Crushed Stone Association. The actual knowledge of what the very best safety engineer in the country knows and what any executive capable of running a plant knows, is very little. The difference lies in what he does, not what he knows.

So, from the standpoint of the National Crushed Stone Association, what I want to say to you is this: That room for improvement is there. The chance to make money is bigger. You haven't anywhere in your business a place where you can invest dollars with as definite a certainty of big returns and as definite a certainty of no loss as you have in investing your dollars in accident prevention work.

I have kept off the humanitarian standpoint up to the present. I am not going to forget that either. I am going to mention it in one way. I hope nobody will forget the good question, "Am I my brother's keeper?" If my brother is on my payroll, you bet your life I am his keeper.

Third Government Test Strikes Substantial Potash

The thickest bodies of potash salts yet revealed by Government tests have been found in the third Government well drilled in Eddy County, New Mexico, according to a statement made public by the Interior Department. The Geological Survey has recently completed analyses of samples selected from the core of this well which show that within 1,500 feet of the surface nine beds or groups of beds of possible commercial interest were encountered. One of these, at a depth of about 1,466 feet, is 8 feet 10 inches thick and contains 11.08 per cent of potash (K_2O) in the sample as received, equivalent to 18.25 per cent K_2O in the soluble salts. Other noteworthy beds range in thickness down to 2 feet 3 inches and in potash content from 8.50 to 13.68 per cent in the samples as received. Only one potash mineral, ($K_2SO_4 \cdot MgSO_4 \cdot 2CaSO_4 \cdot 2H_2O$), was recognized in the samples recovered in drilling, but owing to difficulties experienced in this connection some of the more soluble salts originally present may have been lost. The polyhalite occurred in a number of colors and textures, including a coarsely crystalline variety which is apparently new in this country.

Well No. 3 is in the SW. ¼ sec. 34, T. 22 S., R. 30 E., about 28 miles from Carlsbad. It is one of the group being drilled by the Bureau of Mines under the potash act, which provides for joint exploration by the Geological Survey, representing the Department of the Interior, and the Bureau of Mines, representing the Department of Commerce. The Geological Survey selects the drilling sites and receives and analyses the cores obtained by the Bureau of Mines. The site of well No. 3 is about 11 miles south of the McNutt location, whence the first potash core in New Mexico was taken a few years ago.

LATEST IN LIME PLANTS NOW IN PRODUCTION

BEAUTY and mechanical efficiency have been combined in the new line plant of the Hoosac Valley Lime Company at Zylonite, Massachusetts. This new plant which is now in production has been built on the site of the old plant. The contrast between the two plants is a splendid example of progress and tendencies in the lime industry.

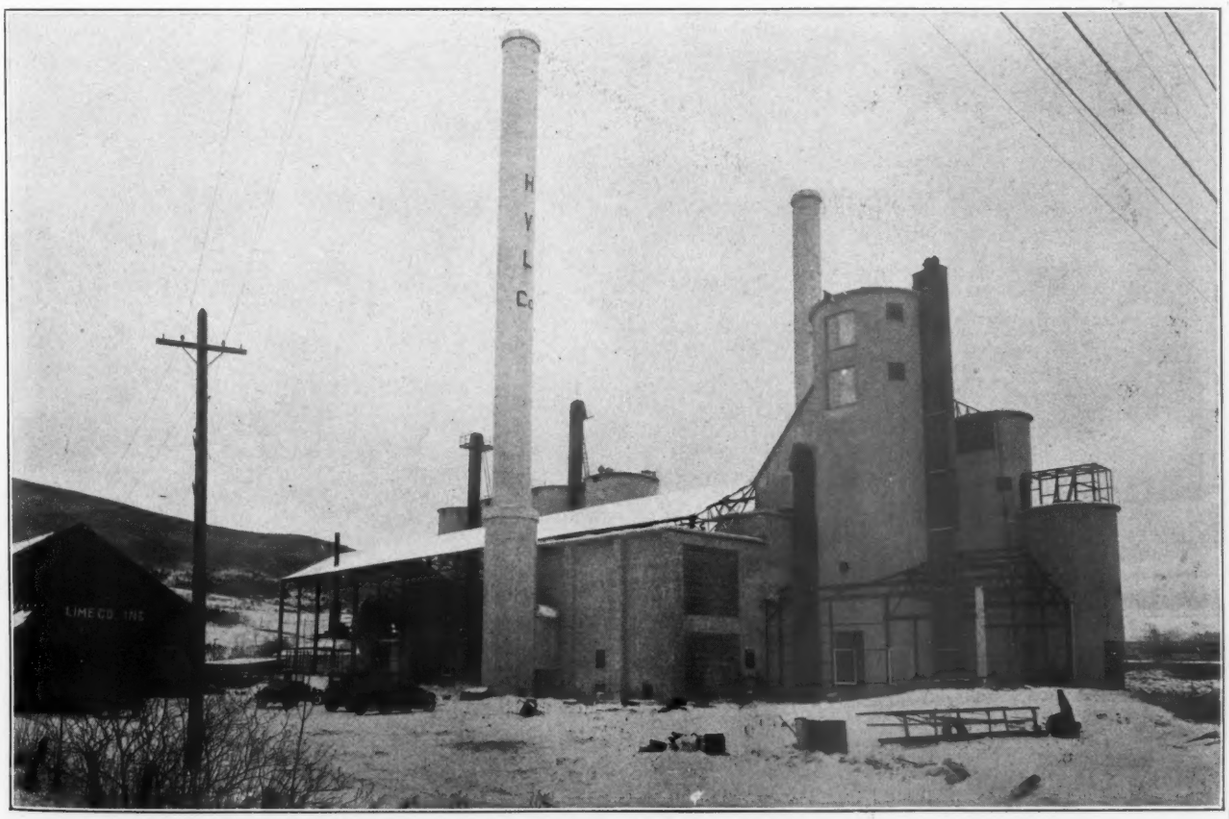
This new plant was designed and completely equipped by the Traylor Engineering and Manufacturing Company for a production of 1,200 barrels per day. The concrete construction work was done by the Burrell Engineering and Construction Company. The illustrations show this concrete work up to advantage. The plant represents a beautiful and permanent group of structures. Rotary kilns are used for burning lime and there are two 8 by 150 foot Traylor kilns. Three double deck vibrating screens handle the sizing. A complete oil burning system has been installed.

Limestone for the kilns is crushed at the quarry by a 12 inch Traylor Bull Dog gyratory crusher and carried by a Link Belt conveyor to a storage tank. Because this tank is located below the quarry, it is possible to have the draw off for loading trucks underneath and at the sides. This also eliminates the use of an elevator for loading the tank from the crusher.

Double quadrant draw off gates, manufactured by the Link Belt Company, have been installed at the bottom of the tank, and a single quadrant gate of the same manufacture is at the side. Trucks and teams are used to take stone from the quarry down the side of the mountain, across the state highway to the crusher, a distance of about half a mile.

Rock is dumped from the trucks into a hopper and is then fed by a Link Belt apron feeder to an elevator which carries it to the top of the first silo. Here two Hummer screens size the rock, removing the smaller sizes. They drop to a belt conveyor which carries them to a double deck Hammer screen where they are separated into three sizes, and dropped into separate screens. The small sizes are not fed into the kilns, but are drawn off through gates to be shipped as chips.

The larger sizes from the first mentioned Hummer screens drop into a 20 by 70 foot concrete tank which is divided vertically into two compartments, to hold stone of two different sizes, stone is drawn off at the bottom of each compartment onto two belt conveyors, which discharge into two elevators, one set for each kiln of the two Traylor kilns. The gates are so arranged that stone of either size, or from either compartment, may be delivered to either kiln.



New Plant of the Hoosac Valley Lime Company

Best oil burners are used in firing the kilns. The gases from combustion and the dust from the kilns are to be passed through a baffled dust chamber before entering the large stack. Oil is stored in two large steel tanks furnished by the Chicago Bridge and Iron Works.

Each of the conveyors, at the bottom of the tank, is provided with a Schaeffer poidometer to accurately measure the material fed to the kilns. The coarse crystalline stone at this plant disintegrates in the burning, making the product of the rotary kiln a true and natural granular lime. The Link Belt Company is furnishing all belt conveyors, screw conveyors and elevators.

Traylor coolers, 6 by 50 feet each, are located directly under the respective kilns, but are protected by screens at the discharge ends and any material other than granular lime coming over the top of the screens is taken away by hand. The two screw conveyors are so arranged that either cooler may feed either conveyor. The conveyors are so arranged; as shown on the flow sheet, that each feeds two lime storage tanks which are 20 feet in diameter by 62 feet high.

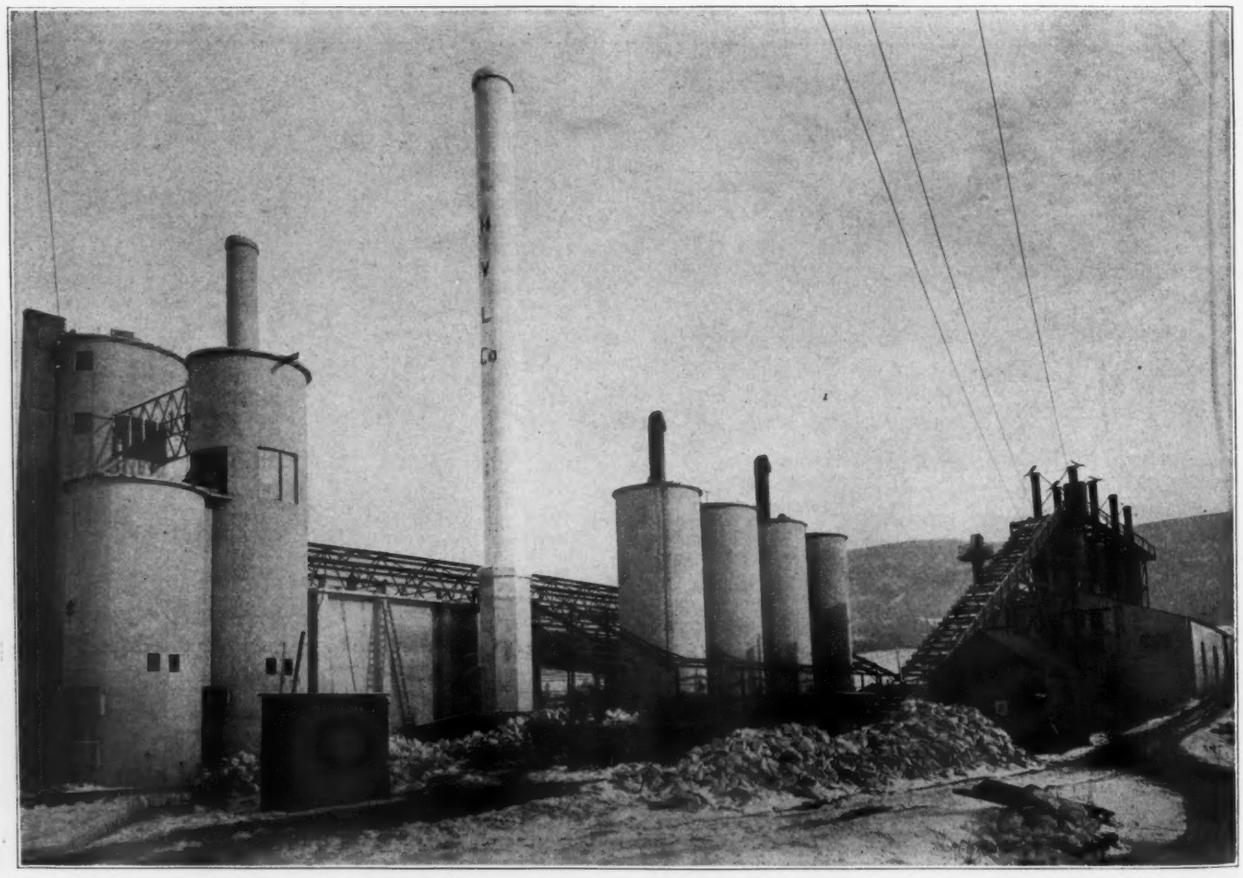
Railroad tracks have been laid to the plant under the tank, where it is believed 75 tons per day will be loaded in barrels. They will stand on continuous barrel shakers and all material will pass over weighing machines. From this plant layout, it is observed that complete and consistent mechanical handling is performed from the dumping of the stone into the first hopper until the filled barrels are ready to be headed.

German Austrian Bauxite Agreement

It is reported that the Bauxite Trust A. G. (Austria) has come to an agreement with the I. G. Farbenindustrie in regard to supplying the latter with bauxite. The reason for this agreement is found in the fact that the Farbenindustrie is to use bauxite in the production of phosphoric acid by the Lilienroth-Urbain process. It is proposed to mix two tons of bauxite with one ton of crude phosphate, and obtain as a by-product a high grade bauxite cement of more economic importance than the phosphoric acid. All tests in this matter have been completed and it is reported that the practical use of this invention will be made in the near future. In order to cover the large demand for bauxite by the Farbenindustrie the Bauxite Trust A. G. will greatly extend its plant and to that end will in the near future considerably increase its stock capital.

Instructive and Interesting

J. A. Patterson, Thomas Patterson and Son, Ltd., Firgrove Hill, Farnham, Surrey, writes as follows: "We find PIT AND QUARRY a most interesting and instructing publication."



New Hoosac Plant With Old Plant at Right

SPEED REDUCERS

Use and Application in the Pit and Quarry Industries

By H. W. Munday

Part Two

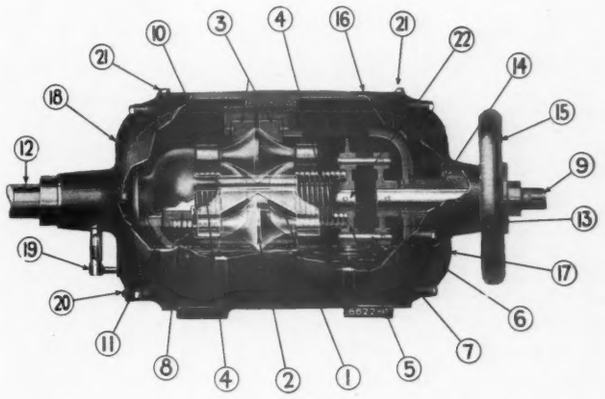
APPLICATION of speed reducers has taken place at a rapid rate and extensively in the cement industry. Application has not been as general in the crushed stone, sand and gravel, lime and gypsum industries. Why, we are not prepared to say. Possibly it is because the cement industry has found speed reducers an economic necessity while the other industries mentioned have not yet come to fully realize the possibilities. We hope that these articles will assist in a consideration of the more general use of speed reducers in the crushed stone, sand and gravel, lime and gypsum industries.

There are numerous outstanding examples of the use of speed reducers in the crushed stone, sand and gravel and lime industries. Some of these will be mentioned and illustrations accompany these articles showing application in the different divisions of the pit and quarry industries.

The Michigan Limestone and Chemical Company of Rogers City, Michigan, have made some clever applications of speed reducers. In one instance here Falk reducers are hooked up in tandem making a rather novel arrangement of using two motors and two speed reducers for tandem drive. Each motor pulls 150 to 200 h.p. Another interesting application in the same plant is the use of a Falk reducer for driving a shaker feeder. The eccentrics for reciprocating the shaker feeder are directly attached to the low speed shaft of the speed reducer. This is made possible because the reducer has double ended low speed shafts.

The Huron Portland Cement Company have a particularly efficient plant. They have applied Huron, Falk and Link Belt speed reducers to advantage. One novel application here is on a cylindrical dryer. The unusual thing is that the speed reducer and the motor are set at a slant, that is, they are inclined at the same angle as the dryer which means 5/8 inch per foot. This means nothing in the operation of the reducer but the motor even though it has sleeve bearings is functioning much smoother than the other motors which set on a level. Practically the entire vibration has been taken out of the drive which should ultimately result in a considerable saving in the replacement of broken parts.

Another instance of a motor and speed reducer setting on a slant is found at the plant of the Peerless Portland Cement Company in Detroit. Here a Falk speed reducer is applied to two Traylor kilns. There is only a small clearance on these drives between the motor or speed reducer and the kiln shell so that they receive direct heat radiation from the shell of the kiln. The motor is protected with an asbestos lined sheet metal housing. The speed reducer has no protection from the heat yet the temperature of the oil in the reducer, in continuous service, is only 22 degrees higher than the air between the reducer and the shell of the kiln. The Ward Sand and Gravel Company, who operate at Oxford, Michigan, the largest sand and gravel plant from a productive capacity standpoint in the world, have a number of speed reducers in service. These are 100 h.p. Falk units and this power is unusual in the sand and gravel industry.



J. F. S. Variable Transmission Unit

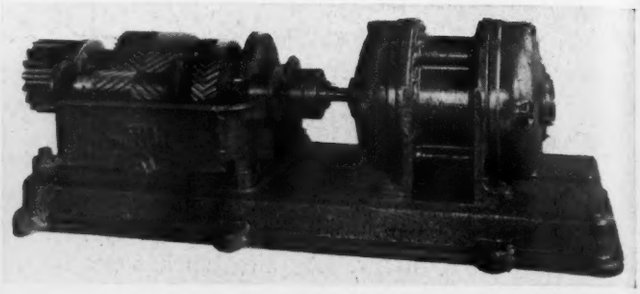
There are any number of interesting and unusual applications of speed reducers in the pit and quarry field. Many are being shown by the illustrations and others will be mentioned in part three. Let us now consider some of the particular units.

Variable Transmission Unit

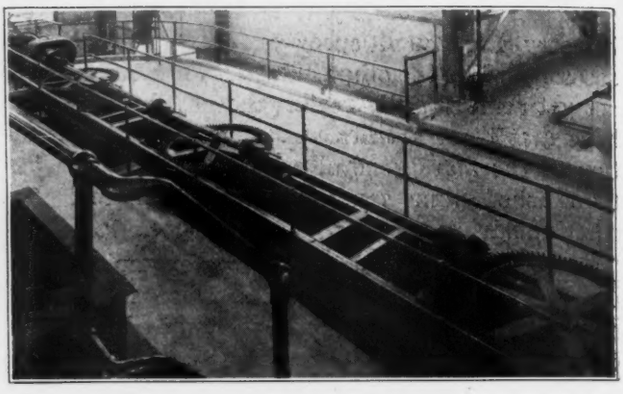
There are classes of equipment which because of their function and characteristics necessarily must be driven at varying speeds. Where temperature and rate of operation, for instance, must be definitely related it is necessary that means be provided for regulating the rate of rotation. Another instance, where the rate of feed can be proportioned to a wide fluctuation in demand some means for changing the rate of feed could be applied with economy.

One such device for serving these needs is the J. F. S. variable speed transmission manufactured by the Stephens Adamson Manufacturing Company. This J. F. S. variable speed transmission performs the function of receiving power at high speeds and delivering that same power at lower speeds for the direct operation of machinery equipment to which the unit may be attached. The

Jones Worm Gear Reducer Driving Line Shaft for Spider Feeder Under Storage Bins in Raw Department of Kosmos Portland Cement Company Plant.

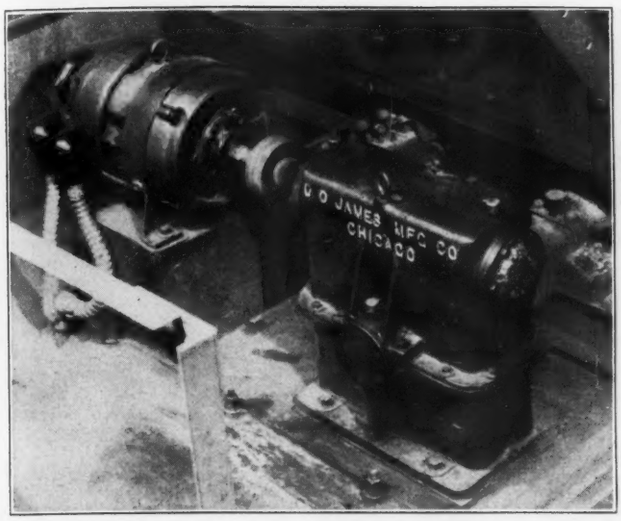


Link Belt Herringbone Reducer



Palmer Bee Unit Driving Three Vertical Agitators at Peerless Portland Cement Plant

Link Belt Herringbone Reducer Driving With Chain Drive a Screw Conveyor at Huron Portland Cement Company Plant.



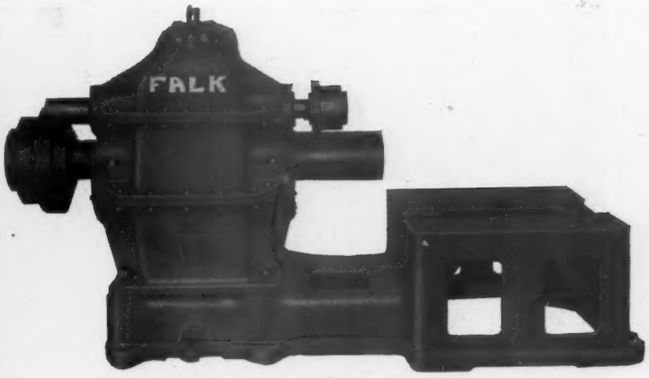
James Heavy Duty Worm Reducer Driving An Apron Feeder Below Grizzly Screen

rate of rotation of the low-speed shaft may be decreased or increased over a wide range, under absolute control. The slightest speed variations are effected with the regulation of the hand wheel.

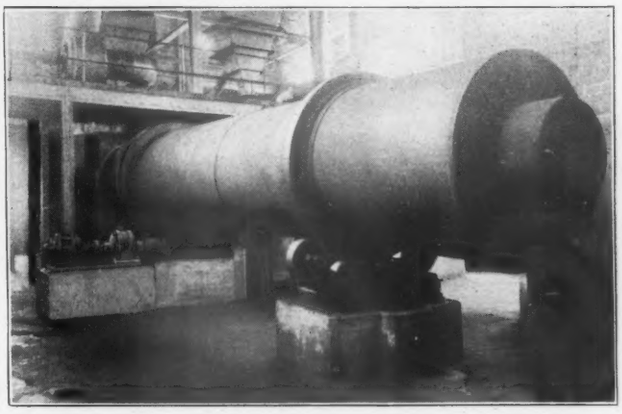
The ingenious application of an entirely new principle has resulted in this variable speed changing device which operates quietly, efficiently and without vibration. Here are roller bearings in the new role of transmitting power at a variable rate of speed. The actual transmission of power is accomplished through the resulting action of genuine roller bearings revolving in polished races, submerged in oil. The pressures between the rollers and races of JFS transmissions sufficient to transmit their rated horse powers are only a fraction of the allowable unit pressures common to the usual ball and roller bearing loadings. The hand or sprocket wheel is easily turned to adjust the rate of rotation of the low-speed shaft to any speed within the range.

Variations in speed are made without interruption while the machine is in motion. The machine may be driven in either clockwise or counter-clockwise direction with the same efficient results. The standard variable speed transmissions are made in sizes to transmit ½ to 15 h.p. at the maximum reduction. There are two distinct series of these machines. The first series provides a reduction of approximately 8 to 1 for the lowest speed. The second series provides a reduction of approximately 40 to 1 for the lowest speed. Each of the series has a variable range of approximately 5 to 1, as is shown in the following examples:

The series "R" transmission directly connected to a 1200 r.p.m. motor will furnish power at any speed from 150 r.p.m. up to 750 r.p.m. The series "RG" transmission directly connected to a 1200 r.p.m. motor will furnish power at any speed from 30 r.p.m. up to 150 r.p.m.



Falk Double Reduction Herringbone Unit



A Tube Mill Driven Through a James Planetary Spur Gear Reducer

W. A. Jones Foundry and Machine Company manufactures both spur and worm gear reducers. The standard spur gear reducers are made in single and double types. For small ratios up to fifteen to one the single type is employed, while for larger ratios the double type is employed. All parts of the Jones spur gear reducers are made interchangable. The housing is cast iron with removable heads. All reductions in the Jones spur gears are accomplished by means of plain spur gears.

The pinions and gears are of high carbon steel. The pinions are forged integral with the shaft. The gears are forged separately and pressed on the shafts after being bored and key seated. The bearings are made of phosphor bronze.

The worm of the Jones worm gear reducer is made from a low carbon alloy steel forging. The rear end of the worm shaft is mounted on a twin or double Timken taper roller bearing. These bearings are designed to carry radial and thrust loads simultaneously. The front end of the worm shaft is supported by a large heavy duty Hyatt roller bearing. The worm gear is made of a phosphor bronze alloy. The worm gear shaft is made from a steel forging. The wheel shaft is mounted on large Timken taper roller bearings. The housing is of cast iron.

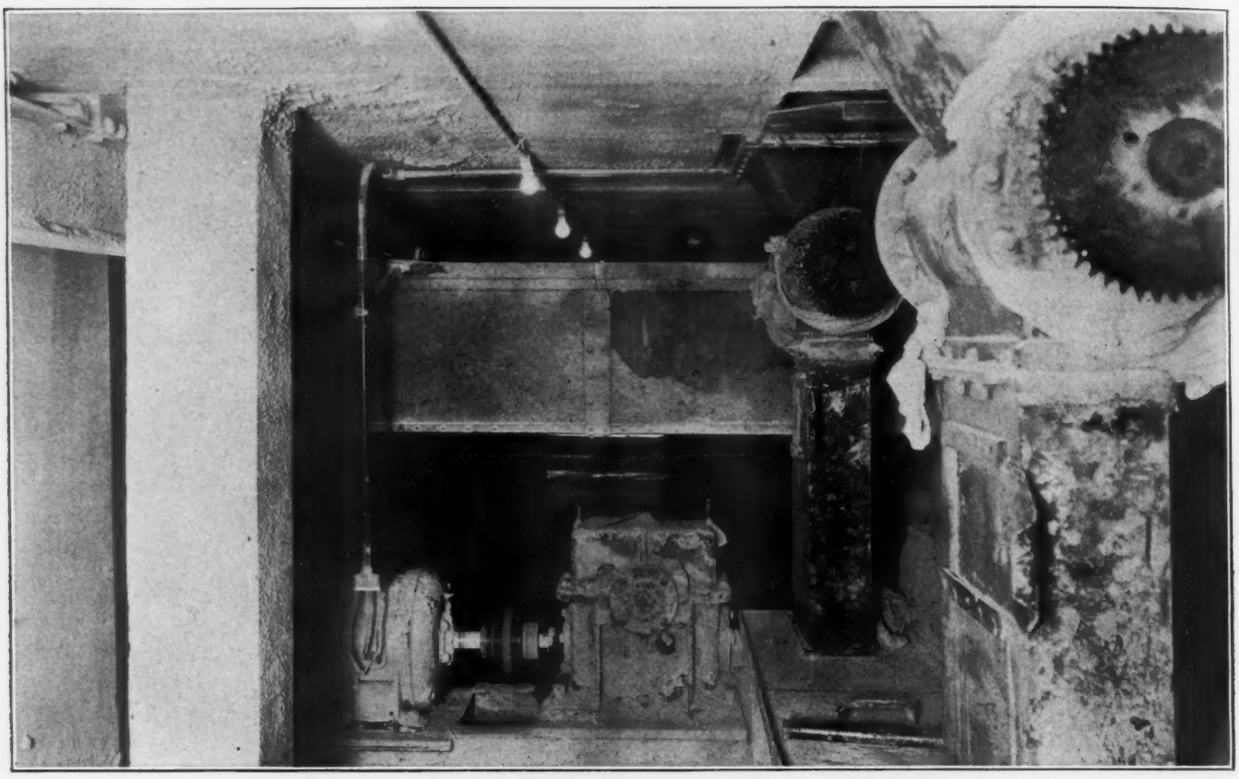
D. O. James Manufacturing Company manufactures spur and worm gear reducers. The spur re-

A James Spur Gear Reducer Used for Secondary Drive on a Bag Cleaning Machine in Cement Plant.

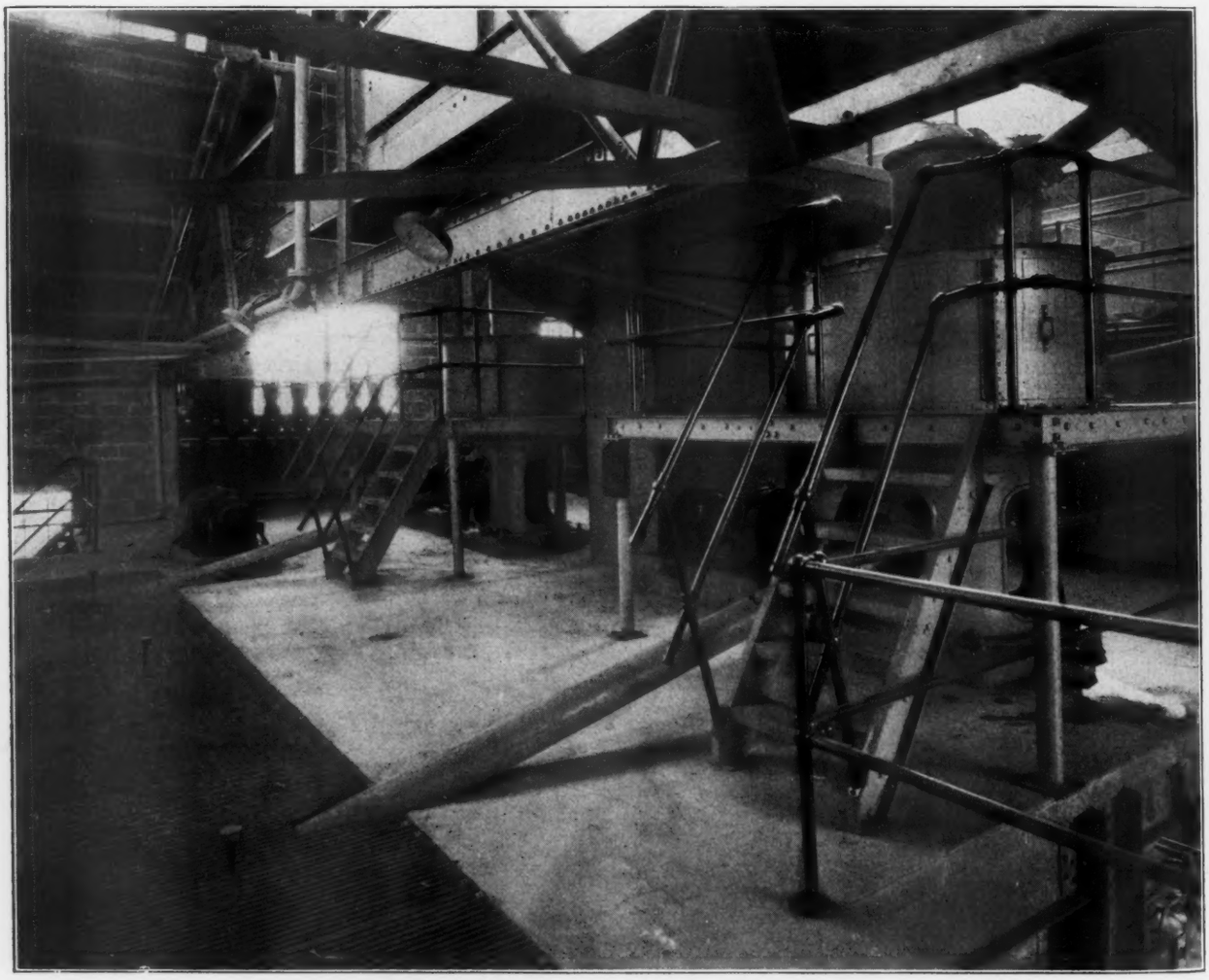
Kilns in Large Cement Plant All Driven Through James Reducer.

Jones Heavy Duty Worm Reducer Direct Connected to Sand Conveyor Headshaft in Plant of U. S. Silica Company

A Cleveland Reducer Driving Rotary Cooler in Lime Plant of American Lime and Stone Company



Jones Worm Gear Reducer Driving Screw Conveyor Under Storage Bins at Kosmos Portland Cement Plant

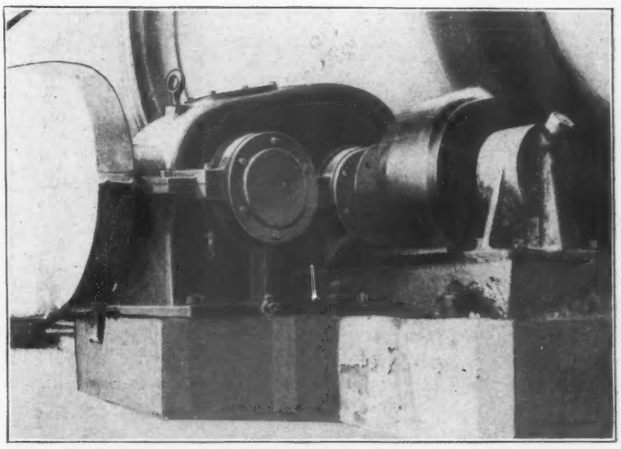


Trix Mixers Driven Through James Spur Gear Reducers

ducers are made in single, semi-double, double, semi-triple, triple and quadruple types. The single reduction unit has a single set of gears with one internal gear. The semi-double unit has two sets of gears with one internal gear. The double unit has two sets of gears with two internal gears. The semi-triple unit has three sets of gears with two internal gears. The triple type has three sets of gears with three internal gears. The quadruple unit has four sets of gears with four internal gears.

The high speed pinion is made of high carbon alloy steel. The medium and high speed pinion gears are constructed of high carbon alloy steel. The intermediate gears are made of high carbon alloy steel also. There is a different set of phosphor bronze bushings for each set of intermediate gears. The discs are made of high grade semi steel as are also the internal gears. The casing and supporting feet are cast in one piece and are of gray iron. The James line of spur gear reducers offers a range of reduction from four to one and up to 1600 to one and even higher.

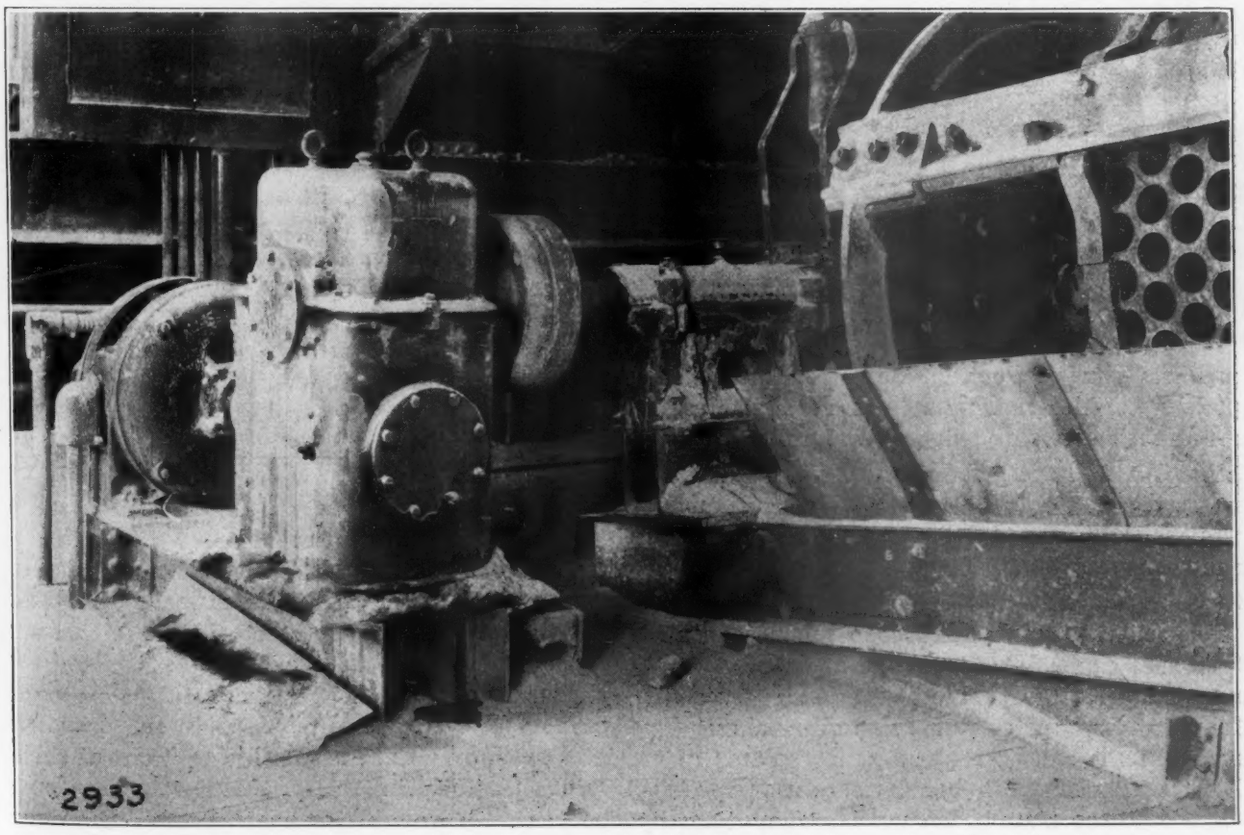
In the James worm gear reducer, the worm is made of high carbon steel. A ball thrust bearing is placed on each side of the worm to take care of thrust loads in either direction. Where the speed is excessive, the worm shafts are mounted on combined radial and end thrust bearings. The worm gear is made of either cast iron or phosphor bronze, the latter recommended for high speeds and heavy duty. The housing is of cast iron.



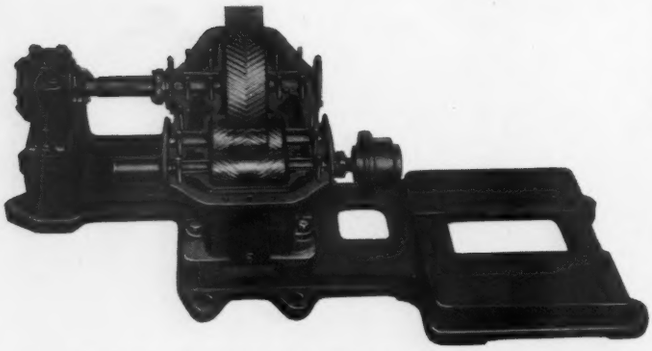
A Right Angle Drive James Herringbone Unit on a Tube Mill in a Cement Plant

The Falk Corporation introduced the herringbone gear reducer in the United States in 1910 and has specialized in this type. The standard Falk units are designated according to the number of reductions employed in obtaining a range of ratios. The single reduction units are for a speed ratio range up to ten to one. The double reduction units from ten to one up to seventy to one. The triple reduction units from seventy to one up to three hundred to one.

In the Falk units gears in small sizes are made from high quality steel forging while gears in larger sizes are made from Falk special Telactic steel. The housing is made of gray iron and is equipped with aluminum oil retainer and shaft



Cleveland Reducer Driving a Large Sizing Screen in Plant of Lake Erie Limestone Company



Falk Double Reduction Unit With Outboard Bearing and Flexible Coupling

guards. Pinions are special heat treated alloy steel. Shafts are annealed forgings medium carbon steel of large size. Bearings are the airplane type lined with high grade tin base babbit. Lubrication is by an automatic continuous system of special design. The efficiency of the Falk units is from 96 to 98 percent at full loading depending upon type and conditions.

Huron Industries Incorporated manufacture a mill type speed reducer. The housing is made of semi-steel. The shafts are made of heat treated steel cut from forged steel or special alloy steel. The reduction gears are of special alloy steel designed for ample overload. The bushings and bearings are of Huron manufacture and are made of phosphor bronze. A positive force feed and bath system of lubrication is employed which is a special feature of this unit.

The Link Belt Company manufacturers a Sykes herringbone gear reducer known as type "RC" reducer. This unit is a combination of the standard herringbone reducer from the motor or high speed shaft and a finished steel roller chain drive separately encased and running in oil for transmitting the power from the herringbone gear unit to the driven machine. This unit has the usual advantages of an enclosed drive, and in addition it is possible to alter the speed of a driven machine at small expense. A change of the small driving sprocket effects the change in speed. A selection of sprockets can be kept on hand for the various speeds desired. Links can also be added or removed to shorten or lengthen the roller chain.

The Caldwell speed reducer was put on the market last year by H. W. Caldwell and Son Company. It is made in two models; Type "A" for general industrial service, and Type "B" specially designed for screw conveyor service.

Two separate drives are used in this unit; a Link Belt silent chain drive from the high speed shaft, and a cut spur gear drive to the low speed shaft. The silent chain drive runs in an oil retaining casing, while the spur gears run at low speeds in an oil bath. Timken roller bearings are used.

Speed ratios may be changed at any time by substituting different sized motor pinions or silent chain wheel. No flexible coupling to the motor shaft is required in this case as the silent chain provides the necessary flexibility. The speed reducer is made in sizes to furnish ratios from 7:1 to 40:1 in Type "A", and to 30:1 in Type "B".

In the next part of this article other units manufactured by Foote Bros., Gear and Machine Company, Hill Clutch Machine and Foundry Company and others will be discussed. More actual installations will be referred to. Some of the operating conditions involved will be dealt with and some suggestions given on the selection of speed reducer units.

Derives Both Pleasure and Knowledge

H. E. Smith, of the Stony Creek Gravel Company, Orland, California, writes: "For more than four years now we have been receiving PIT AND QUARRY, and can honestly say that we derive both pleasure and knowledge from its careful perusal. I say careful, because we do go through it carefully and thoroughly, especially during our slack season, and usually read all the articles therein contained because they are really enlightening."

Concrete in Britain in 1927

Reinforced concrete was used in Great Britain to a greater extent than ever before. Many very large and important structures have broken with English tradition and have employed concrete as their building material. Reinforced concrete is now used almost as a matter of course for the smaller type of bridge, but there is still in some quarters an architectural prejudice against the use of the material for monumental bridges in large cities. Concrete is being used as the structural material for important new bridges at Glasgow and Berevick, and both are as pleasing in their different styles as any modern bridge built of other materials. Sales of rapid hardening cement were double those of the previous year, and, as the price was reduced in the autumn, it is certain that this rate of progress will continue through 1928.—Editor (Concrete and Const. Eng., January, 1928).

Waterproofing Concrete

Articles made of concrete are waterproofed by treating them with a mixture of alum and dissolved shellac. In the preferred method of preparation an aqueous solution of alum is boiled until a thick liquid is obtained, and this is mixed with shellac dissolved in alcohol, acetic acid, soda, borax, or potash to form a thin paste, in the proportion of 8 parts by weight of alum to one part of shellac solution. Sufficient water is added to the paste to carry it into the pores of the concrete.—E. Doggett (British Patent 281,022).

PIT AND QUARRY FOREIGN DIGEST

Soduim Silicate and Concrete

Commercial sodium silicate solutions containing 33% solid sodium silicate (Na_2O, 3.5 SiO_2) behave as true colloidal solutions, practically separation of silica and soda taking place on dialysis or diffusion tests. On mixing such solutions with precipitated calcium carbonate and exposing the mixture in thin layers to the air a rapid loss in weight occurs during the first few days due to evaporation of water, but subsequent loss is slight and the total loss is always a constant fraction of the weight of the silicate solution. The first apparent action is the formation of a gel, followed after long storing by the appearance of small needle-shaped crystals of hydrated sodium metasilicate. Even after the lapse of a year, no appreciable change takes place in the calcium carbonate particles. After a short period of exposure, addition of water regenerates the original colloidal solution, but after longer periods an irreversible gel is formed. In the presence of carbon dioxide the separation of the gel is accelerated. From these results the mechanism of the silicification of calcareous building stones after treatment with sodium silicate is explained as follows: The solution dries on the surface with the formation of a film of gel which slowly becomes irreversible, while crystals of hydrated sodium metasilicate form in the interior. The outer layers are slowly decomposed by the carbon dioxide of the air with the deposition of amorphous silica, the sodium carbonate simultaneously formed being washed away by rain. The solution which has penetrated into the pores of the stone is slowly decomposed by the impurities present, calcium carbonate itself being inert, and insoluble double silicates are thus formed in the pores, thereby strengthening the resistance of the stone to further atmospheric denudation.—P. Gavelle (Chim. et Ind. *18*, 564-85; A. R. Powell, B.C.A., January 20, 1928).

Decomposition of Cements

Chemical reagents are capable of decomposing the mortars either if they exert a solvent action on the ingredients or if they combine with these constituents. In the case of decomposition by means of combination of foreign salts with the cement constituents, a characteristic blowing of the mortar occurs as in the case of the decomposition of cement by calcium sulphate. Combination with calcium sulphate occurs by formation of Candlot's sulphoaluminate. The mechanism of this decomposition resembles the mechanism of the slaking of lime. If the calcium sulphate combines with the aluminate in dissolved condition, the blowing does not occur, as with fused aluminous cement. This theory can be generalized. Every reaction which takes place between solid salts without previous solution results in a lessening of strength. The reaction between dissolved salts has no harmful effect upon the mortar. This theory holds true for the reaction between "fat" lime and anhydrous calcium aluminate, but does not hold true for the hardening of blast furnace cements. The blast furnace slags seem to combine with lime without previous solution.—Henri Lafuma (Congress of Chemical Technology, Paris, in Zeit. f. Ang. Chem., Dec. 29, 1927).

Aggregates of Slag and Clinker

Blast furnace slag used as aggregate must be neither strongly acid nor basic, an average amount of silica in an acid slag being 40 per cent, and the lime content of a basic slag, 43 per cent. Basic slags are crystalline and bond well with the cement, whereas acid slags are glassy and do not adhere well to the cement. Some basic slags disintegrate on cooling, especially if they have a high lime content, but a slag which forms no powder after 14 days will remain stable indefinitely. Sulphide sulphur is present in the fresh slag, but if this is not above 2 per cent, the slag may be used without ill effect, provided the slag is compact. Clinker for aggregate must be free from coal and other impurities and carefully selected. It must be partially sintered and not contain more than 1 per cent calcium sulphate. It is advisable to sieve out the very fine particles, making up the aggregate with sand. Clinker makes a fairly good aggregate and has low heat conductivity and fire resistant qualities.—Lea & Brady (Dept. Sci. Ind. Res., Building Res., Spec. Rept. No. 10, 1927).

Magnesium Oxychloride Cement

An X-Ray study of powdered magnesium oxychloride cements shows the crystalline 3 MgO, $MgCl_2$, 12 H_2O in the cement after setting. Magnesium hydroxide together with magnesium chloride solution yields a product in which definite crystalline structure could not be found, although it appears possible that imperfect crystals might be present. The diffraction lines of magnesium oxide cannot be found in the diffraction diagram of hardened cement. The presence of crystals in the cement is not, however, a confirmation of Le Chatelier's theory, as these crystals may be of the dimensions of colloidal particles.—T. Maeda (Inst. Phys. Chem., Tokio and Brit. Chem. Abs.).

Preserving Concrete

Concrete is coated and impregnated with pitch and similar substances by forming holes, channels or grooves, 8 to 10 millimeters deep all over the surface which allow the impregnating medium such as pitch, hydrocarbons, resins, etc., to penetrate to the deeper layers.—R. Rostock, Vienna

DISTRIBUTION OF CEMENT

The following figures show shipments from Portland cement mills distributed among States to which cement was shipped during November and December, 1926 and 1927.

Portand cement shipped from mills into States, in November and December, 1926 and 1927, in barrels*

Shipped to	November		December	
	1926	1927	1926	1927
Alabama	134,009	252,077	117,426	155,046
Alaska	173	132	297	132
Arizona	27,412	52,276	39,536	59,434
Arkansas	79,627	85,638	42,245	57,179
California	887,351	1,027,706	901,526	826,042
Colorado	61,057	74,276	31,711	26,653
Connecticut	147,288	170,103	52,141	86,678
Delaware	17,682	20,630	6,528	11,949
District of Columbia	78,369	70,727	64,457	35,784
Florida	418,696	142,655	317,402	113,512
Georgia	161,710	143,624	110,139	82,539
Hawaii	21,417	8,726	25,732	15,410
Idaho	25,409	16,447	13,199	4,450
Illinois	776,758	880,391	446,515	355,233
Indiana	289,720	289,212	108,771	95,953
Iowa	116,116	123,547	37,153	23,998
Kansas	169,035	218,395	88,010	54,317
Kentucky	120,647	114,964	62,172	54,834
Louisiana	74,619	110,968	89,843	87,947
Maine	19,168	30,019	6,255	10,829
Maryland	212,972	180,358	135,181	79,514
Massachusetts	234,087	237,558	72,231	116,135
Michigan	702,901	641,339	292,167	288,891
Minnesota	87,777	96,509	40,916	31,387
Mississippi	61,685	97,083	60,858	54,701
Missouri	315,318	305,254	152,647	122,565
Montana	16,169	14,205	6,455	7,373
Nebraska	64,198	58,307	26,933	22,308
Nevada	4,751	6,789	3,150	7,165
New Hampshire	32,190	34,719	18,340	17,710
New Jersey	688,736	672,737	255,744	335,550
New Mexico	18,965	23,695	13,639	8,574
New York	1,584,352	1,514,114	788,046	974,050
North Carolina	276,568	264,393	183,912	112,931
North Dakota	8,869	5,437	2,439	1,506
Ohio	651,257	675,806	312,336	265,784
Oklahoma	225,767	319,776	120,560	166,633
Oregon	75,541	80,653	47,637	51,119
Pennsylvania	1,013,955	932,367	469,376	483,869
Porto Rico	7,250	.....	13,250	.....
Rhode Island	47,278	58,352	19,813	23,079
South Carolina	46,692	133,046	31,523	76,157
South Dakota	10,076	13,870	3,625	1,573
Tennessee	124,551	174,923	82,556	96,493
Texas	419,358	506,726	303,770	320,825
Utah	34,358	30,046	12,944	13,669
Vermont	14,455	21,938	3,844	12,700
Virginia	127,290	145,820	61,351	76,872
Washington	131,602	129,611	90,856	95,166
West Virginia	104,150	104,307	63,680	42,219
Wisconsin	169,068	214,907	95,776	89,820
Wyoming	8,160	15,407	7,430	7,691
Unspecified	54,253	32,465	396	14,566
	11,200,962	11,575,030	6,354,439	6,176,514
Foreign countries	75,038	43,970	77,561	49,486
Total shipped from cement plants	11,276,000	11,619,000	6,432,000	6,226,000

*Includes estimated distribution of shipments from three plants in November and December, 1927; and from five plants in November and December, 1926.

Production, shipments, and stocks of finished Portland cement, by months, in 1927 and 1928 (figures represent thousands of barrels)

	Production		Shipments		Stocks at end of month	
	1927	1928	1927	1928	1927	1928
January	8,258	9,782	5,968	6,531	22,914	25,193
February	7,377	.....	6,731	.....	*23,563	.....
March	*11,450	.....	*11,100	.....	23,922	.....
April	14,048	.....	14,350	.....	23,654	.....
May	16,701	.....	16,865	.....	23,503	.....
June	17,224	.....	19,761	.....	20,972	.....
July	17,408	.....	18,984	.....	19,397	.....
August	18,315	.....	21,411	.....	16,292	.....
September	17,505	.....	19,828	.....	13,996	.....
October	17,174	.....	18,105	.....	13,141	.....
November	14,449	.....	11,619	.....	*16,022	.....
December	11,999	.....	6,200	.....	21,821	.....
	171,908	.....	170,922	.....	.....	.....

*Revised.

Estimated clinker (unground cement) at the mills at end of each month, 1927 and 1928 (figures represent thousands of barrels)

Month	1927	1928	Month	1927	1928
January	9,989	9,349	July	9,609	.....
February	11,943	.....	August	7,887	.....
March	12,997	.....	September	6,490	.....
April	13,335	.....	October	5,960	.....
May	12,514	.....	November	6,374	.....
June	10,926	.....	December	*7,599	.....

*Revised.

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in December, 1927

	Barrels	Value
Alaska	311	$ 976
Hawaii	14,261	34,806
Porto Rico	6,275	14,392
	20,847	$50,174

PORTLAND CEMENT IN JANUARY, 1928

The Portland cement industry in January, 1928, produced 9,782,000 barrels, shipped 6,531,000 barrels from the mills, and had in stock at the end of the month 25,193,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of Portland cement in January, 1928, showed an increased of nearly 12 per cent, and shipments an increase of about 11 per cent, as compared with January, 1927. Portland cement stocks at the mills were 11 per cent higher than a year ago.

The statistics here presented are compiled from reports for January from all manufacturing plants except four, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity, the total output of finished cement is compared with the estimated capacity of 155 plants at the close of January, 1928, and of 141 plants at the close of January, 1927.

New Incorporations

Northwestern Gravel Co., Mandan, N. D. 10,000 shares n.p.v.

Jayhawk Sand-Gravel Co., 1524 Harrison St., Topeka, Kans. $20,000. Howard Yingling, E. G. Saunders, R. A. Keefover, J. E. Yingling, C. E. Garlinghouse.

Joseph Hendler Stone Quarry & Construction Co., care Corporation Service Co., Wilmington, Del. $10,000. To quarry stone. Helena Hendler Funke, Charles H. Funke, Ashely Borough, Pa.; Clara Hendler Brennan, James T. Brennan, Carl M. Hendler, Wilkes-Barre, Pa.

Knox County Gravel Co., Vincennes, Ind. $25,000. To quarry sand, gravel, stone. Henry E. Lane, John J. Lane, William Eichel.

Colby Gravel Co., McCoy St., Granville, Ill. $50,000. H. K. Ward, N. H. Colby, H. L. Packingham.

Union Sand & Gravel Co., Wichita, Kans. $50,000, pfd.; 1,000 shares n.p.v. To pump along Big Arkansas River. Ben F. Hegler, attorney.

Trimmer Sand, Gravel, Limestone Co., Morristown, N. J. $300,000. LaMont V. Trimmer, Elizabeth K. Trimmer, Middle Valley, N. J.; Clifford Mills, Lenah T. Mills, Morristown, N. J.

N. C. Taylor Resigns

N. C. Taylor has resigned as sales manager, assistant secretary treasurer and director of the Augusta Lime Company, Inc., of Stanton, Virginia.

William Speed Appointed Sales Representative

The Kentucky Rock Asphalt Company has appointed William Speed sales representative for the eastern half of Kentucky. Captain Speed has had considerable experience as an engineer in road construction, having been head of the Speed-Parker Construction Company which built over $2,000,000 worth of roads in Kentucky, North Carolina and Florida.

New President Elected By Universal

Announcement of a change in management featured the recent annual meeting of stockholders of Universal Gypsum and Lime Company in Chicago. Mr. Eugene Holland, president of the Holland Lumber Company of Omaha, Nebraska, has been elected president and general manager of the gypsum organization, following the resignation of Mr. L. M. Palmer, Jr.

It is of special interest to lumber and building material dealers that the new executive has had wide and successful experience in the retail lumber business. After several years with another firm, he organized in 1917 the Holland Lumber Company at Lincoln, Nebraska. In 1923 the business branched to Omaha and in 1926 to Sioux City, Iowa. Headquarters have been maintained at Omaha, Nebraska.

Mr. Holland has been a prominent business man. He is a member of the Board of Directors and the Executive Committee, as well as chairman of the Aviation Committee of the Omaha Chamber of Commerce. His retail building material experience is of great value to the Universal Company, as he takes to the larger organization the viewpoint of a merchandiser. He is unusually well qualified to carry on the dealer sales policy that has been the guiding factor in the past success of this well-known manufacturer of plaster, gypsum wallboard, Insulex and other gypsum products.

Universal Gypsum and Lime Company has continuously rendered service to dealers on the basis of quality products and efficiency of production and distribution. Recent acquisition of the Higginson Manufacturing Company, with the gypsum plant at Newburgh, New York, 270 acres of gypsum deposit at Windsor, Nova Scotia, and a lime plant at Ossining, New York, has rounded out a complete line of gypsum products for eastern markets.

In the Southwest, the installation of a modern lime hydrator and other equipment of latest design at the Oglesby, Texas, lime plant provides for the production of bulk, masons' hydrated and lump limes. Production there will supplement the manufacture of gypsum products at the Rotan, Texas, plant. Continued production at the Fort Dodge, Iowa, and Akron, N. Y., gypsum plants, and the York, Pa., and Oranda, Va., lime plants completes the extensive program of this company's distribution of recognized materials.

Relation of Production to Capacity

	January 1928	January 1927	December 1927	November 1927	October 1927
	Per cent	Per cent	Per cent	Per cent	Per cent
The month	49.5	45.1	60.7	75.9	87.4
The 12 months ended	74.5	76.4	76.2	73.7	73.6

Production, shipments, and stocks of finished Portland cement, by districts, in January, 1927 and 1928, and stocks in December, 1927, in barrels

District	January Production 1927	January Production 1928	January Shipments 1927	January Shipments 1928	Stocks at end of month 1927	Stocks at end of month 1928	Stocks at end of December 1927*
Eastern Pa., N. J. and Md.	2,510,000	2,351,000	1,422,000	1,545,000	5,116,000	5,886,000	5,080,000
New York	318,000	549,000	165,000	316,000	1,438,000	1,761,000	1,529,000
Ohio, Western Pa. & W. Va.	563,000	755,000	420,000	458,000	2,620,000	2,926,000	2,630,000
Michigan	448,000	374,000	261,000	295,000	2,093,000	2,220,000	2,141,000
Wis., Ill., Ind., & Ky.	923,000	1,408,000	464,000	501,000	3,441,000	3,480,000	2,573,000
Va., Tenn., Ala., Ga., Fla. & La.	899,000	1,109,000	921,000	938,000	1,167,000	1,851,000	1,680,000
Eastern Mo., Ia., Minn. & S. D.	509,000	1,096,000	247,000	284,000	3,199,000	3,544,000	2,731,000
Western Mo., Neb., Kan. & Okla.	468,000	451,000	398,000	451,000	1,847,000	1,622,000	1,623,000
Texas	383,000	463,000	365,000	447,000	461,000	423,000	407,000
Col., Mont., Utah	121,000	175,000	77,000	67,000	518,000	473,000	364,000
California	974,000	939,000	1,088,000	1,111,000	551,000	616,000	788,000
Ore. & Wash.	142,000	112,000	140,000	118,000	463,000	391,000	396,000
	8,258,000	9,782,000	5,968,000	6,531,000	22,914,000	25,193,000	21,942,000

*Revised.

EXPORTS AND IMPORTS

*Compiled from the records of the Bureau of Foreign and Domestic Commerce (Figures for 1927 subject to revision).

Exports of hydraulic cement by countries in December, 1927

Exported to	Barrels	Value
Canada	1,025	$ 3,913
Central America	14,172	45,042
Cuba	4,301	14,537
Other West Indies and Bermuda	2,769	6,460
Mexico	5,845	18,864
South America	27,779	101,530
Other countries	6,208	36,614
	62,099	$226,960

Imports of hydraulic cement by countries, and by district, in December, 1927

Imported from—	District into which imported	Barrels	Value
Belgium	Florida	17,397	$ 24,949
	Galveston	3,000	3,777
	Massachusetts	41,745	53,245
	New Orleans	200	252
	New York	6,001	7,445
	Oregon	2,000	2,437
	Philadelphia	16,588	23,818
	Porto Rico	5,000	6,127
	Rhode Island	15,637	20,602
	South Carolina	14,050	17,418
	Virginia	2,913	5,922
	Washington	4,000	5,534
	Total	128,531	$171,526
Canada	Maine and New Hampshire	931	2,328
	Vermont	1,332	1,981
	Total	2,263	4,309
Denmark	Porto Rico	24,313	30,489
Germany	Los Angeles	1,000	2,173
United Kingdom	New Orleans	500	704
	New York	2	4
	Total	502	708
	Grand Total	156,609	$209,205

Exports and imports of hydraulic cement, by months, in 1926 and 1927

Month	Exports 1926 Barrels	Exports 1926 Value	Exports 1927 Barrels	Exports 1927 Value	Imports 1926 Barrels	Imports 1926 Value	Imports 1927 Barrels	Imports 1927 Value
January	72,939	$ 216,431	75,346	$ 254,072	360,580	$ 576,717	193,175	$ 269,661
February	73,975	220,706	71,404	233,985	314,118	527,945	130,421	200,680
March	69,080	205,647	67,956	240,165	493,241	812,968	181,145	261,519
April	96,296	284,772	72,383	243,832	257,302	398,114	191,868	313,262
May	78,601	224,365	59,332	205,574	223,130	337,031	178,929	263,618
June	80,684	248,814	69,205	237,281	335,570	495,744	129,111	201,682
July	130,822	370,220	72,337	229,737	250,862	395,981	175,035	249,665
August	64,946	216,489	61,371	209,198	350,638	560,532	117,605	170,167
September	70,920	239,174	57,888	207,817	194,129	308,224	233,066	297,716
October	69,389	225,874	67,639	230,668	263,403	386,335	221,274	321,777
November	76,598	238,103	79,869	257,476	55,233	82,949	141,485	190,419
December	89,976	305,238	62,099	226,960	151,850	246,293	156,609	209,205
	974,226	$2,995,833	816,829	$2,776,765	3,250,056	$5,128,836	2,049,723	$2,949,371

INTIMATE NEWS OF MEN AND PLANTS

Nazareth Makes Improvements

The Nazareth Cement Company, Nazareth, Pennsylvania, has been making extensive additions and improvements to its plant. These consist of a rock crushing plant, a Cleveland crane, a Fairmont roll crusher and other machinery. In addition, changes were made in the kiln department, new conveyors and clinker storage were installed together with conveyors and a gypsum storage and handling building were among the recent refinements.

Hauser Opens Quarry

The Hauser Construction Company has opened a quarry on Coos River near Marshfield, Oregon, for the purpose of getting the material to be used in the jetty construction near Empire. The representative of the Company, W. H. Harrison, has purchased rails, locomotives and cars for the work.

Northwestern Starts Work

The Northwestern Cement Company will start operating its plant at Grotto, east of Index, Washington, early in March. The buildings are finished, the 9,000 foot tramway is completed and crews are erecting the bunkers at the quarry.

Kyrock Opens New Quarries

In addition to opening a new quarry at Sweden, Kentucky, the Kyrock Asphalt Company has added two 21 ton locomotives and 15 flat cars to its equipment at the older quarries. Superintendent Carmichael stated that the improvements will increase the output by 250,000 tons this year.

Sparks Enlarges Plant

Sparks Brothers have been making extensive improvements at the plant located at Thirty-eighth Street and D Avenue, Anacortes, Washington, and are prepared to furnish washed sand and gravel at the rate of 200 yards per day. A well has been dug and additional bunkers are planned for erection later.

Michigan Purchases Acreage

The Michigan Lime and Chemical Company has purchased about 2,000 acres of land in Presque Isle County, Michigan, according to reports from Adena where the deal was closed. The tract which was owned by Leavitt and McPhee lies along the shore of Thompsons Harbor. Extensive deposits of stone are located on the land affording a large supply for use in the calcite plant.

Iowa Sand and Gravel Expands

The Iowa Sand and Gravel Company has definitely planned to increase the output of its Eddyville, Iowa, plant by 100 per cent. The company has leased considerable acreage, is building a narrow gauge road and installing a supplementary screening and dewatering plant; the main operations are being rebuilt and additional shovels and cranes together with additional auxiliary equipment will be installed.

Russian Professor Visits California Gravel Plant

Prof. A. E. Serebrowsky, head of the mining department, University of Moscow, recently visited the Vallecite Western Gravel plant near Stockton, California. He made a thorough investigation of the properties and was presented with two gold nuggets and a fragment of cement gravel inlaid with gold. During that week the mine produced over $4,000 in gold which was taken from the gravel excavated to make a storage room.

California Association Moves Offices

The Southern California Rock Products Association announces the removal of its offices to the Bradbury Building, Los Angeles, California. E. Earl Glass will continue as manager, while organizing other trade groups of the industry. He was formerly secretary of the Southern California Chapter Association of Contractors and is president of the local chapter of the American Association of Engineers.

Quarry Company Holds Safety Banquet

The Holston Quarry Company recently gave a safety banquet in the high school building at Strawberry Plains, Tennessee, at which Charles Gaut, superintendent, acted as toastmaster. The banquet was given to encourage a safety campaign and as a commendation to the employes in charge of safety work. Prominent speakers addressed the guests on safety problems and practices and reports of safety committees were read and discussed.

Quarry Reopens

W. H. Skolfield, vice-president of Merritt Chapman and Scott, which was recently awarded the contract to complete the breakwater at Santa Barbara, has opened the quarry on Santa Cruz Island. He has given employment to 150 men according to reports emanating from the San Pedro office of the company. The work of quarrying the material and completing the breakwater will be under way and completely organized in a few days.

Acme Gravel Builds Plant

The Acme Gravel Company has purchased property at Twenty-sixth and Peralla Streets, Oakland, California, for the immediate construction of a modern sand and mixing plant at a cost of approximately $100,000, it has been announced. The plant will consist of light concrete bunkers, automatic conveying machinery and necessary equipment.

California Rock Exceeds Value of Gold

The total value of the sand, crushed stone and gravel prepared for use in building and construction in the State of California, during 1927, was in excess of $18,500,000 according to the report of the Mining Bureau. The value is one and one half as much as the combined worth of all the gold, silver and platinum mined in the state last year.

Honoulu Purchases Sand

A contract calling for the shipment of a large quantity of sand from Manhattan Beach, California, has been signed by the Honolulu Iron Works Company and Chamberlain and Company of 2550 East Ninth Street, Los Angeles, California. Chemists employed by the Honolulu Company found the sand satisfactory and the work has been started by the Kahn Company of Manhattan Beach.

Alabama Company Opens Office

The Alabama Sand and Gravel Company of Montgomery, Alabama, has opened a sales office for the Birmingham district at 208 Martin Building, Birmingham, Alabama, and J. D. Wilson, who has been connected with the company for more than four years, will be the representative there.

NEWS OF EQUIPMENT MANUFACTURERS

Power Transmission Book Issued By Hill

The Hill Clutch Machine and Foundry Company is distributing its new 258 page illustrated General Catalog, number 26, on Power Transmission Machinery. In addition it contains diagrams, tables and engineering data which is intended to eliminate all guess work in the selection of proper power transmission units and may be used as a reference work. The bound volume is divided into three sections.

Section 26-A is replete with information on shaftings, couplings and bearings together with the engineering information concerning the auxiliary equipment.

Section 26-B deals with clutches, pulleys, and belt tighteners. These cover a wide range of uses for almost any need together with the information on applying them to the class of work desired.

Section 26-C is concerned with rope drives, agitators, gears, sprockets and speed transformers. It contains information on this particular equipment which is of much assistance to the operating engineer.

School for Arc Welders Is Opened

The Lincoln Electric Company has entirely reorganized and re-equipped its school of welding. Its purpose is the training of electric arc welders; and though each individual instruction represents a considerable expenditure, no tuition or fees are charged.

A number of standard 200 ampere "Stable-Arc" welders have been installed in line with a series of booths in which the pupils do their work. The welding unit that serves each man stands directly before the booth in which he practices. All the wiring except the necessary leads to the electrode holders is concentrated in conduit and the floor spaces is kept clear and clean.

The course continues for thirty days and consists of twelve lessons, as follows: The contact of the arc, its characteristics and manipulation; the nature of welding rods and depositing materials; the operation and care of the welding machine; the nature of vertical and overhead welding; testing welds for porosity and strength; welds on cost iron and their percentage of strength; the advantages and future of carbon arc welding; welding of copper and bronze castings; the use and abuse of pressure welding; the assistance to the human element in "Stable-Arc Welding Rod;" the construction of welded machine tools; and the simplicity and strength of welded fixtures.

The pupils in this school work under the direction of a trained instructor who teaches them both as a class and as individuals. All the educational work comes under the general direction of A. F. Davis, vice-president of the company. With this intensive training, men are able to acquire a sound working knowledge of the fundamentals of electric arc welding, and are fitted to engage competently in the trade.

Orton Elects Officers

At the annual meeting of the officers and directors of the Orton Crane and Shovel Company, recently held at Huntington, Ind., where the manufacturing plant is located, P. A. Orton, Sr., was re-elected president and general manager, and Harry Shaffer was re-elected treasurer.

P. A. Orton, Jr., formerly in charge of sales in the Chicago territory, was elected vice-president and sales manager, and Herbert Mertz was elected vice-president in charge of sales in the New York territory. Alex Orton, works manager at Huntington, Ind.; C. C. Case, of Chicago, and J. L. Kenower, of Huntington, also were elected members of the board of directors.

New Republic Trucks

The Republic Motor Truck Company, Incorporated, has brought out a complete new line of trucks consisting of the model 88, one and one-third yards capacity; the model 58, two yards capacity, and the model S-25WB, three and one-half tons capacity, according to an announcement by J. C. Haggart, Jr., vice-president of the Republic Company.

The advantages of Model 88 will be recognized by experienced truck users. With an exceptionally heavy frame, large spring shackles, special rear platform spring design, oversized, sturdy transmission and rear axle, and short wheelbase, this Republic has the agility to get in and out of crowded quarters and at the same time has the excess strength and power to stand up under severe working conditions. In this model, either a 4-cylinder or 6-cylinder engine may be had as standard equipment. Both motors are fundamentally designed for truck use, and each assures great power with surprising economy. Ample traction is guaranteed by the 30 by 5 inch heavy duty pneumatic front tires and 30 by 5 inch heavy duty dual rear pneumatics. The rear spring construction includes a heavy transverse platform type rear spring—a design developed by Republic engineers as ideally adapted to gravity dump trucks.

For the severest sort of work scraping, grading of all kinds, where the operations depend upon interruptionless trucking, the model S-25WB shows to best advantage. The engine is a specially designed truck type with combustion features insuring great power with fuel economy, and normal engine heat under long, heavy pulls. Force feed lubrication and such additional features as the air cleaner and gascolator add to engine life. The herringbone gear double reduction rear axle gets every ounce of power from the mighty engine to the rear wheels. The two-stage rear springs adequately cushion loads of varying capacities under all road conditions.

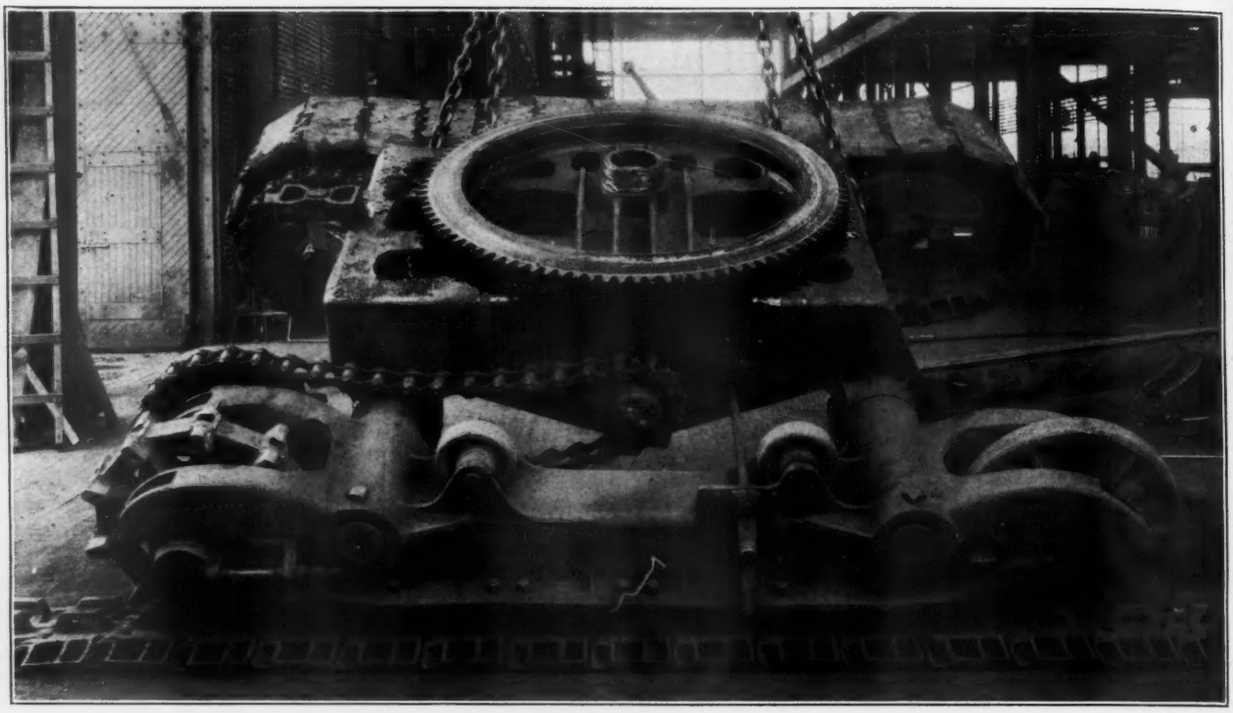
The model 58 assembled with four to six cylinder engine, is a short-wheelbase truck, designed to carry a 2 yard dump body and power hoist. The heavy frame which is generously crossbraced, is tapered over the rear axle in order to obtain the important advantage of low frame height without sacrificing axle clearance. A feature of model 58 is the bevel gear rear axle, fully oil-bathed, with wide gear faces to insure long life and dependable efficiency under constantly severe operating conditions.

Dunlevy Leaves Climax

Lorimer Dunlevy has resigned his position as sales manager for the Climax Engineering Company, of Clinton, Iowa, effective March 15th, to take on new duties as general sales manager for the O. E. Szekely Company of Holland, Michigan, makers of commercial airplane engines and other products now in process of design.

New Barber Greene Office

Barber Greene Company has recently established a new branch office located at 431 Temple Bar Building, Cincinnati, Ohio. This branch is to be under the supervision of Mr. Paul Frederick, district manager. Mr. Frederick has been with the Barber-Greene Company for nine years and comes to Cincinnati from the Barber-Greene office in Detroit.



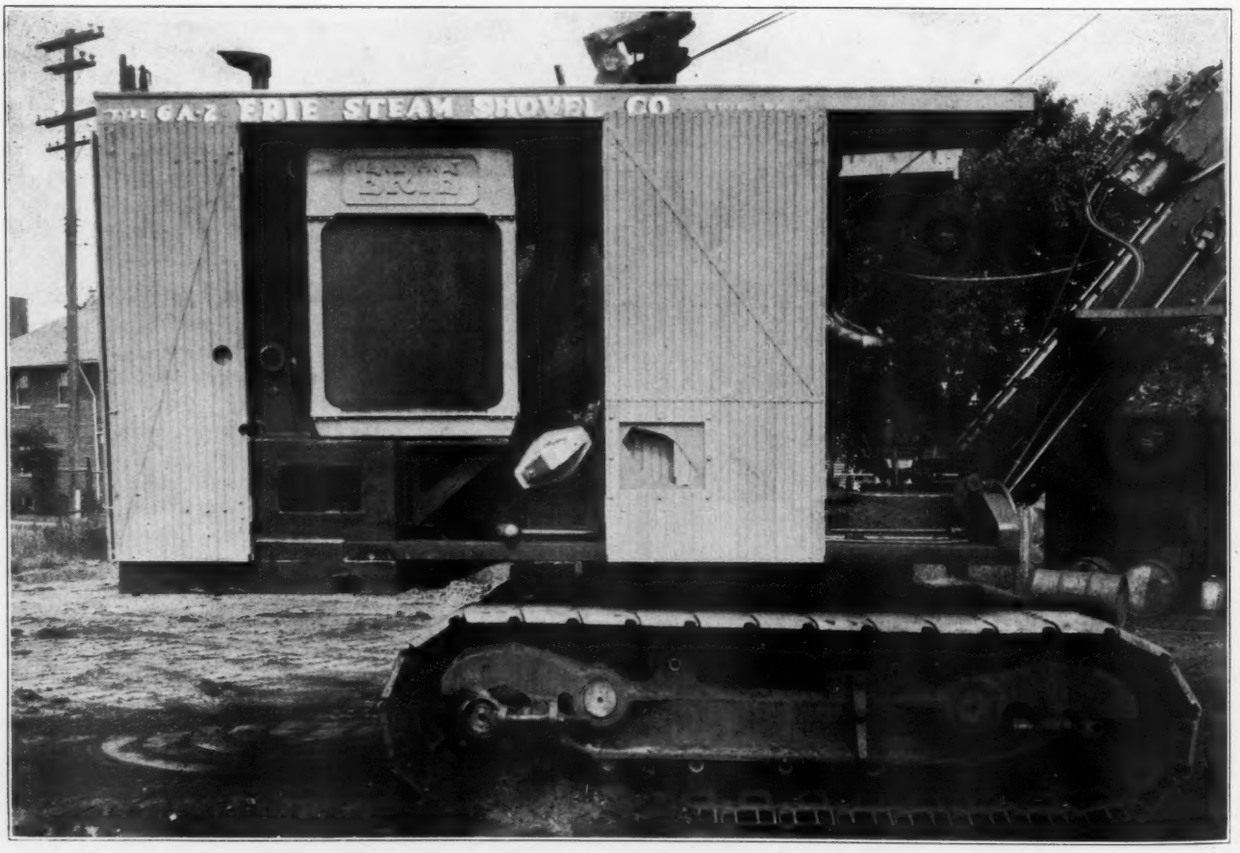
The One-Piece Truck Frame Casting

New Shovel Mounting

One of the most important new developments in excavating machinery for the pit and quarry industries, noted in recent convention exhibits was the "Single Shaft Drive" caterpillar type mounting for shovels and cranes introduced by the Bucyrus-Erie Company.

Since caterpillar type mounting has come to be recognized generally as the most satisfactory for power shovels and cranes used in quarry and gravel pit service, the most important consideration now is to get the continuous-tread mounting in its simplest and most reliable form.

As the new Bucyrus-Erie mounting has fewer parts, extra strength can be built in with no added weight. Besides which, this new mounting combines several unique features that

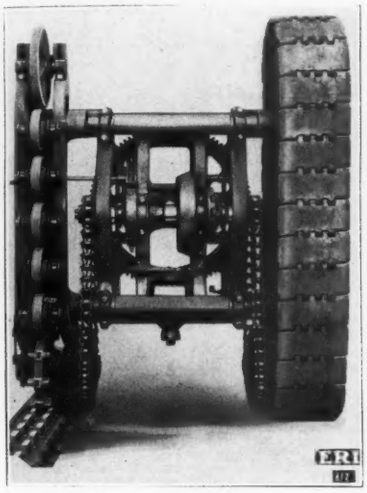


Erie Shovel With New Mounting

users are finding very valuable in service.

The "Single Shaft Drive" mounting is in the highest degree non-clogging—even when it is shoveled full of material, it throws out the material as it moves ahead of its own length. The drive chains, which are of hardened forged steel, are self-cleaning.

It easily takes grades of 30 per cent, and steeper. A 2-way brake, which operates with a ratchet effect, allows free movement in either direction as desired, but locks the machine against the digging, or on a grade.



Showing One Drive Shaft Below Deck

Sharp turns can be made with this mounting as well as gradual turns. It can make either a right angle turn in one spot, or a long radius turn—steering from either end of the treads, with the machine moving forward or backward.

Another feature of this new mounting is its perfect accessibility for renewing or inspecting parts. Any wearing part of this mounting can be quickly and easily removed without disturbing any other part.

With only one drive shaft and one gear below the deck, the extreme simplicity is very noticeable. The one gear and its pinion are enclosed, protected against dirt and grit—and operate high above the ground. There is 12-inch clearance underneath; nothing to drag when moving over rough uneven ground.

The truck frame is a one-piece annealed steel casting, 23 inches deep—practically indestructible. Shafts are splined—no keys. Threads are exceptionally strong, and have 1½" hardened steel pins.

All Gas+Air and B-2 Steam Bucyrus-Erie machines are now being furnished with this new mounting as standard equipment. Its absolute simplicity and extra strength, combined with its exceptional performance on many machines which have seen unusually hard service, have shown it to be the ideal mounting for shovel and crane work in quarries and gravel pits.

Georgia Portland Cement Going Ahead With Plant

Construction of a $2,000,000 plant for the Georgia Portland Cement Corporation at Sandersville, Georgia, is expected to begin early in the summer, according to the H. K. Ferguson Company, who are designing and will build the huge mill.

Officers of the new company report that financing of the project is progressing satisfactorily. J. Lee Hankinson is president of the firm which is bringing this big industrial development to the outskirts of Augusta, John C. Hagler is vice-president, and H. W. Neill is secretary and treasurer.

The new type of quick-hardening cement, which dries in 24 hours to three or four days instead of requiring two or three weeks, will be manufactured in the new mill at the rate of 600,000 barrels a year.

Location of the new mill is ideal, as it adjoins a rich bed of limestone containing about 13,000,000 tons, which engineers estimate would last 40 years if a million barrels of cement were produced yearly. The limestone is of a variety which crushes easily, thus requiring less power than the average. The vicinity provides plenty of good clay also, and the mill site is within reach of two railroads, making transportation an easy matter.

W. H. Kewish, special engineer of the H. K. Ferguson Co. for cement plant design, is directing plans for the equipment, which will be of the most modern and efficient type. R. F. Bell, another Ferguson engineer, has charge of the building design.

Westinghouse Promotes

A number of important promotions in personnel, involving executives of the manufacturing organization, have been made recently by the Westinghouse Electric and Manufacturing Company. Announcement has been made by J. M. Hipple, works manager of the East Pittsburgh Works, of the appointment of E. C. Brandt and F. J. Shiring as assistant work managers, and of J. E. Webster as chief plant engineer. Changes simultaneously announced by E. R. Norris, general works manager, are the appointment of A. E. Kaiser as director of production for all works and S. C. Hoey as works manager of the Homewood Renewal Parts Works.

St. Louis Group Elects

At the annual meeting of the St. Louis Quarrymen's Association, February 15th, the retiring President, Louis Skrainks, was given a vote of thanks for his excellent work during 1927. Under his direction two advertising campaigns were carried on—one dealing with Limestone as an Aggregate, and the other, a joint campaign with the Associated Stone Mason Contractors, covering the use of Rubble and Building Stone, which resulted in considerable tonnage gains. At the meeting Wm. Eyermann was elected president; Theodore Fehlig, vice-president; and J. W. McCullough, secretary-treasurer, and Col. E. J. McNahon was continued as executive secretary.

During the year, the Association was successful in securing a reduction of about 25 per cent in the state liability insurance rate. This Association is a very small one, but makes up for this by its unusual activity—two and three officers from each quarry being present at all meetings.

Width of Gyplap Changed

The width of Gyplap sheathing boards has been changed from 32 inches to 24 inches, according to an announcement from the United States Gypsum Company. As now manufactured, each board is 24 inches wide, eight feet long and one-half inch thick.

A need for greater convenience in handling the boards, before and after application, made necessary the new width. In the new size, it is possible for the carpenter to carry two boards at a time, one under each arm. The new size also makes application easier. The one-half inch gypsum core of Gyplap sheathing, the tongue-and-groove edges and the waterproof surfacing remain unchanged.

Ohio Valley Appoints Sales Manager

The Ohio Valley Rock Asphalt Company, Starks Building, Louisville, Kentucky, has appointed James B. Wilson sales manager. He is well known as a consulting engineer, and was in recent years chief engineer of the Louisville Water Company and for a time city engineer. The plant and quarries of the asphalt company are at Summit Hardin County, Kentucky.

Ires Prosser Appointed

Ires Prosser has been appointed representative of the Botfield Refractories Company of Philadelphia, Pennsylvania. His territory will include North Carolina and Texas with offices in Atlanta, Georgia.

Describe Rotary Car Dumpers

The Roberts and Schaffer Company is distributing its 1928 illustrated bulletin 163, Rotary Car Dumpers. Some of the advantages claimed for the rotary dump and solid wagon are considerable labor saving in dumping and controlling cars; lower car cost and lower maintenance costs; reduces dangers from personal injury; less degradation of material; less loss of material along haulage en route; considerably greater car capacity for the same outside dimensions; and in addition the car dumper will take care of almost any make of cars. The bulletin illustrates and gives the advantages of car feeders, spraggers and weigh baskets. It is announced, that the engineering department makes a specialty of adapting the mobile equipment of Roberts and Schaffer to any fixed or pre-arranged condition.

New Yale Tractor

The Yale model K24C four wheel drive tractor has been brought out to meet the demands for an electric driven tractor of heavier type. The machine is capable of an ultimate draw bar pull in excess of 4000 pounds, depending upon road surface conditions, and will operate a continuous draw bar pull of 1000 pounds without danger of overheating. By driving all four wheels of the machine, it is possible to get the maximum of traction with the given overall weight of machine. Not only has the machine the power to pull on slippery surfaces, but it also has the power to stop as it is equipped with four wheel brakes. These brakes operate through the differentials so that they properly equalize. The spring which automatically applies these brakes when the operator either raises his foot pedal or steps off the machine, is directly connected to the brake shoes, so that any disarrangement of the linkages between the foot pedal and the brake lever, would in no way hazard the driver of the machine. Should this linkage fail, the brakes would immediately apply.

The steering is accomplished through a lever handle so arranged that the handle may be folded out of the way. The steering knuckles on all four driving wheels are each equipped with a ball flush bearing which greatly enlightens steering. The driving units applied in this truck consist of two standardized units connected in parallel at the controller. The employment of standard units in this heavy duty tractor, allows a maximum of interchangeability as there need be maintained but one set of repair parts. It would be possible to interchange the drive units of this tractor, with any of the Yale K line of industrial trucks.

The frame construction of the tractor is unique in that the pressed steel side members or main supporting members or main supporting members are integral parts with the axle yokes. This gives the frame a depth of 18 inches, producing a member thoroughly capable of standing jolts and jars in addition to the usual bending stresses of which it is subjected. The bumpers are heavy, being made of ½ inch plates and a triple bumper casting front and rear gives a range of coupling height that will meet practically every requirement.

Describes Diesel Locomotives

The Fate-Root-Heath Company is distributing its illustrated "Condensed Bulletin A-20" describing the models OL, XL, JLD, and WL Plymouth Diesel Locomotives. These locomotives were developed for more efficient and economical transportation.

Model OL, 10 and 12 ton locomotives, is especially adapted for light tracks, long hauls, heavy grades and sharp curves, where a heavier model would not be practical. Its power is derived from a 4 cylinder, 4 cycle enclosed type Atlas Imperial full Diesel engine, 6½ by 8½, developing 77 h.p. at 650 r.p.m. with a constant pressure fuel system and full force feed lubrication.

Model XL 50 ton locomotive was designed for short line railroad haulage with speeds up to 36 miles per hour, switching, general industrial haulage, quarries, sand and gravel plants, and many uses of like nature. It is equipped with a Foos Type L 8½ by 11 Diesel engine, generating 350 h.p. at 700 r.p.m.

Model JLD, 12 and 15 ton locomotives, was especially designed for general construction work, quarries, sand and gravel plants, lumbering, clay plants, mining and general industrial haulage. They will negotiate long heavy grades and sharp curves in places where a heavier model could not be used. The power is derived from a 4 cylinder, 4 cycle Buda M.A.N., 6 by 8 Diesel engine developing 97 h.p. at 1000 r.p.m. The lubricating system is of the forced pressure feed type, carrying approximately 40 pounds pressure on all bearings at 1000 r.p.m. The frame is of rolled steel girder section which forms a rigid base for the heavy engine and the transmission.

Model WL, 25 and 30 ton locomotives, was designed for general industrial haulage, short line railroads with a speed up to 25 miles per hour, switching, sand and gravel plants and general hauling. The 6 wheel drive permits the use of this locomotive on light rough track and with a 6 cylinder, 4 cycle, 7½ by 10½, 165 h.p. Atlas Imperial engine will negotiate long, heavy grades. The frame is of rolled steel girder section with wheels and axle springs set in lower flange so that the track gauge of the locomotive may be changed by changing axles and the position of the springs and journal boxes.

Rollway Bearing Issues New Bulletin

The Rollway Bearing Company, Incorporated, is distributing new illustrated literature describing its products among which is catalog number 4-A which features the "Wide Series Bearings" so termed because they are usually made in sizes in which the length of the bearings along the shaft is much larger in proportion to the diameter than the so-called "maximum" type. Among those described are the type WS, to be used when both the shaft and housing are hardened; type A provides an external bearing surface for the rollers, when it is convenient to harden the shaft but not the housing; type B with solid outer sleeve; type C with solid inner and planished outer sleeves; type D with solid sleeves; and different classes of utility bearings.

Bulletin number 53 illustrates and describes Rollway self-aligning pillow blocks with adapter bearings to fit standard commercial shafting. These pilow blocks are used where the loads are too heavy and the service too severe to use ball bearings and are equipped with maximum type adapted bearings with standard adapters.

Engineering Bulletin 54 is concerned with precision types of Rollway radial bearings, identification chart and key to dimensions. This includes a number of different types of bearings with bores and outside diameters the same as standard ball bearings, which were designed to meet widely and varying demands of industry.

Bulletin 55 illustrates and describes roller bearing pillow blocks with standard bearings. These are for applications where the shaft can be turned to fit the standard bearing which is pressed on the shaft usually against the shoulder.

Bulletin 56 is concerned with large bearings in international standard sizes. This bulletin lists a number of new sizes from 4½ to 12½ inches in diameter with load ratings from 25,000 to 400,000 pounds. The bearings are known as type MI and are fully interchangeable with the International Standard sizes of the same number.

New Metallic Packing Book Issued By Crane

The Crane Packing Company is distributing its fifth edition of "Metallic Packing," by Julian N. Walton. The 124-page book is primarily a catalogue of Crane's flexible metallic packing, but it is also intended to assist the operating engineer more fully to understand packing problems and point out the way for permanently overcoming packing troubles.

The chapters on Fabric Packing and Metallic Packing are devoted to making comparisons and stressing the idea that the use of frictional substances is inconsistent with sound engineering practice and show that the most difficult packing problems have been solved through the use of the metallic seal.

The text is illustrated with photographs and diagrams of interest to engineers and operating men who are concerned with packing problems. It shows that pressures of any density may be held by proper depth stuffing boxes; and temperatures above maximum can be handled by the proper selection of metals and construction of packing. It covers ordinary packing practice and deals with many special packing problems which have been solved by the most careful study and experimentation.

World's Wire Cloth Record

A world's record has been established by the Newark Wire Cloth Company by making the finest wire cloth ever made which has 160,000 square openings per square inch, or a wire cloth with 400 parallel wires per inch of width running each way, at right angles. In a piece of the wire cloth slightly more than six square inches in area, there are one million holes.

Heretofore the finest wire cloth ever made in the United States has been 325 mesh and it is made by the Newark Wire Cloth Company. It is known as Sieve Number 325 by the United States Bureau of Standards, and has been adopted as standard by the American Society of Testing Engineers.

New Allis Chalmers Motors

A line of squirrel cage induction motors suitable for starting on full line voltage is being placed on the market by Allis Chalmers Manufacturing Company. These motors are normal torque, high reactance machines and will not draw starting current in excess of the limits recommended by the Electrical Apparatus Committee of the National Electric Light Association. They are built in ratings 7½ to 30 h.p., 600 to 3,600 r.p.m., low voltage, and are available with either sleeve or roller bearings. Features of Allis Chalmers construction as employed in squirrel cage motors are maintained in this new line. A magnetic switch with push button control is the only starting equipment required.

"Tractocrane" Described

The Vergan Schmidt Company is distributing an illustrated leaflet, giving the practical demonstrations of the "Tractocrane" to which is attached a mimeographed copy of specifications for the machine. It is used for loading or unloading cars, excavating, laying pipe in trenches or backfilling, dragline bucket or dipper shovel, lifting magnet, pile driving, drilling holes and setting poles, switching railroad cars and many other single or combined operations. It is readily used as a crane, clamshell, shovel, skimmer scoop, trench hoe, pile driver and numerous special attachments may be applied to suit varied conditions and requirements.

Lincoln Appoints Fries

The Lincoln Electric Company announce the appointment of O. D. Fries as salesman in charge of Consumer Motor Business in the Detroit territory under the direction of J. M. Robinson, district manager. Mr. Fries was educated in the Glasgow Royal Technical College and the Glasgow University of Glasgow, Scotland, and since his graduation has had a wide experience in practical and theoretical engineering as well as a wide sales experience.

Hammermills Discussed

The Dixie Machinery Manufacturing Company is distributing its 1928 illustrated 24 page catalog, "Dixie Hammermills" or crushing and pulverizing equipment. Dixie mills are used for the crushing of limestone, shale, gypsum, brick, clay, kaolin, fuller's earth, asphalt rock, barytes, coal, marl or any mineral for which grinding, pulverizing, or crushing is necessary.

The machine is a simple sturdily constructed swing hammer crusher, pulverizer or grinder that makes an effort to incorporate time, labor and money saving principles. The non-clog mogul of which the non clog moving breaker plate is the principal feature, has been used successfully where various structures must be crushed with one operation and is especially adapted to sticky materials. The standard mogul is similar except for the breaker plate which is stationary.

Howard A. Winton Passes

Funeral services were held for Howard A. Winton, of the Heil Company, aged 33, from the Wauwatosa, Wisconsin, Congregational Church, Thursday afternoon, February 9, at 1:30 o'clock, with burial at Prospect Hill, Waukesha County, Wisconsin, which was the old home of the Winton family. Mr. Winton, a veteran of the World War and a graduate from Carroll College, entered the employ of the Heil Company in 1919. He served as advertising manager, general branch manager and secretary of the Hydro Hoist Company.

Howard A. Winton

New Rotary Type Switch

The Westinghouse Electric and Manufacturing Company has put on the market a new rotary type switch, used for connecting any instrument or group of instruments selectively to various circuits as may be required for metering, synchronizing, or other switching functions. These switches are especially adapted to mounting in small space, and present a uniform appearance which will harmonize with instruments and similar apparatus.

The switch handle operates a shaft on which are mounted various contact-making segments which make or break contact with stationary fingers supported on an insulated base. This base is a part of the supporting structure of the switch with suitable top and sides serving to completely enclose the switch parts, and to complete the switch structure. Its terminal board is such as to facilitate any of the accepted methods of switchboard panel wiring and all terminals are numbered.

Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.

RATES PER INSERTION	1 Inch	2 Inches	3 Inches	4 Inches	5 Inches	6 Inches	8 Inches	9 Inches	10 Inches	12 Inches	15 Inches	20 Inches	30 Inches
1 Insertion	$3.75	$7.25	$10.75	$14.25	$17.75	$21.25	$28.25	$31.75	$35.25	$42.25	$56.25	$70.25	$105.00
2 Insertions	3.75	7.25	10.70	14.20	17.65	21.15	28.15	31.65	35.15	42.15	56.15	70.00	104.00
3 Insertions	3.75	7.20	10.65	14.15	17.55	21.05	28.05	31.55	35.10	42.05	56.05	69.75	103.00
4 Insertions	3.70	7.15	10.60	14.10	17.45	20.95	27.95	31.45	35.00	41.95	55.90	68.75	101.00
8 Insertions	3.65	7.05	10.50	14.00	17.25	20.75	27.75	31.25	34.80	41.75	55.70	67.50	98.00
13 Insertions	3.60	6.95	10.40	13.90	17.05	20.55	27.55	31.05	34.60	41.55	55.55	66.25	94.00
26 Insertions	3.50	6.75	10.20	13.70	16.65	20.05	27.05	30.65	34.20	41.05	55.05	64.00	88.00

INFORMATION—*"Broadcast"* space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width. The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

It Pays to Advertise in PIT and QUARRY

James McGraw, Inc., Richmond, Va., advertised an oil engine for sale in one issue. Regarding the results they write: *"We received quite a number of inquiries from the advertisement you ran for us and are pleased to tell you that we have about closed a deal with a party—that is we expect to do so this week."*

Complete Service Publishing Company

538 South Clark Street **CHICAGO**

Machinery for Sale

SPECIALS
1—New 8'x125' Allis-Chalmers Rotary Kiln

CRUSHERS

Crushing Rolls

1—8"x5", 1—16"x10", 4—24"x12", 1—26"x15", 1—30"x10", 1—30"x16", 2—36"x16", 1—42"x16" (New), 1—54"x24".

Gyratory

All sizes from No. 2 Reduction to No. 12K.

Jaw

One 4"x8"—two 7"x10"—one 6"x20"—two 9"x15"—one 10"x20"—two 12"x24"—one 18"x36"—one 24"x36"—one 42"x30" Farrell—one 42"x36" Farrell—one 60"x84".

Rotary

Two No. 0, two No. 1, one No. 1½, and one No. 2 Sturtevant Rotary Fine Crushers.

Ring Roll

One No. 1 and one No. 2 Duplex Sturtevant ring roll mills.

Ball and Tube Mills

3', 4', 4½', 5', 5½', 6', 8' Hardinge Mills and Tube Mills.

DRYERS

One 3'x30', Three 4'x30', One 4½'x30', One 5'x40', One 5½'x40', One 6'x60', One 7'x60' and One 8'x80' Direct Heat Rotary Dryers, One 5'x25', one 6'x30'. Two 8'x80' Ruggles Coles type "A" and One 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.

KILNS

4'x40', 5'x60', 6'x60', 6'x70, 6'x90', 6'x100', 6'x120', 7'x80', 8'x125'.

MILLS

Two 33" and two 42" Fuller Lehigh Mills.
One No. 0000, and two No. 1, one 2-roll, and two 4-roll Raymond.
Swing Hammer Mills, Griffin Mills, Attrition and Cage Mills.
Air separators, Screens, Elevators and Conveyors.

The Heineken Engineering Corp.
Industrial Engineers
95 Liberty St., New York City
Hanover 2450

LOCOMOTIVES

1—56-ton 6-wheel Standard gauge Saddle Tank, new A.S.M.E. boiler, electric head lights, oil burning equipment.

LOCOMOTIVE CRANES

1—30-ton Ohio 8 wheel, double power drums, 50-ft. boom outriggers, factory rebuilt.
1—22½-ton Ohio 8 wheel, double power drums, 50-ft. boom, factory rebuilt.

CATERPILLAR SHOVELS

1—68C Bucyrus electrically operated shovel on caterpillars.
1—20B Bucyrus Steam Shovel on caterpillars.

Morris Engineering Co.
Phone: Cortland 0604
30 Church St., New York

CRAWLER SHOVELS

1—MARION 37, STEAM, Shop No. 5550 series, new late 1926; 1¾ yd. Dipper; Nat. Board Boiler; like new.
1—MARION TYPE 7, GAS & ELECTRIC, Shop No. 5800 series, new 1927; One-yard Dipper; perfect condition.
1—LORAIN-60, GASOLINE, New July, 1927; One-yard Dipper; HIGH LIFT, like new.

CRANES

1—15-ton cap. LINK-BELT K-2, GASOLINE, Caterpillar Crane, new 1925; 50 ft. Boom, Bucket operating.
2—25-ton, 8-wheel, INDUSTRIAL, Type G, Locomotive Crane, New 1927, 50 ft. booms.

DUMP CARS

25—5-yard, 36 in. gauge WESTERN, two-way side Dump, new 1927; STEEL DRAFT BEAMS; used few months, perfect condition.

GREY STEEL PRODUCTS COMPANY
111 Broadway New York, N. Y.

FOR SALE OR RENT

2—Class 24 Bucyrus Electric Draglines, 100 ft. boom, 3½ yd.
1—Link Belt K2 gas. cat. dragline, 45 ft. boom, 2 yr. old.
1—Cl. 14 Bucyrus steam dragline, 60 ft. boom, 2-yd. bucket.
2—O&S gas. cat. cranes, 40 ft boom, 2 yr. old. Excel. cond.
2—Koehrings No. 2, gas cat. cranes, 40 ft. boom, 3 yr. old, overhauled.
1—Erie B traction wheeled steam shovel, ¾ yd.
2—Erie B caterpillar traction steam shovel, ¾ yd., 3 yrs. old.
1—Thew caterpillar traction steam shovel, ¾ yd. Good condition.
1—Lorain 75 Gas cat. shovel less than 1 yr. old, 1¼ yard.
50—4 and 5 yd. Western dump cars, late type, steel sills, good condition.
1—20T Brown Hoist, R. R. Type Crane, 50 ft. boom.

Miscellaneous gas or steam locomotives, compressors, pavers, large stripping shovels, etc. Write your requirements and let me quote you.

F. E. HOUCK
9 S. Clinton St. Chicago, Ill.

FOR SALE OR RENT

DUMP CARS

5—12-yd. Western, Std. Ga., Air. Perfect Condition.

GASOLINE SHOVELS AND CRANES

1—Link-Belt Comb. Gas-Crawler, 1-yd. Shovel and 15-ton, 50 foot boom Crane. Like new.
1—Northwest, Model 105, 50' Boom. 2-yrs-old.

STEAM SHOVELS

1—McMyler ¾-yd. Cat. Steam; also 40' Crane Boom. New 1927.
1—Marion, Model 32, 1¼-yd. Dipper, Full Cat., High Lift, Rebuilt 1927. Perfect shape.

GASOLINE LOCOMOTIVES

2—7-ton Plymouth, 36" Gauge. Like new.
1—8-ton Plymouth, 36" Gauge. Like new.

HOISTING ENGINES

1—40 HP. Mundy, DD, 2-ph., 60-cyc., 220-v.
1—22 HP. Lambert, DD, 2-ph., 60-cyc. 220-v.
1—7x10 Lidgerwood, DC, DD, Boiler mounted with Swinger attached

BOILERS

1—125 HP. Locomotive Type, ASME, 125 lb. Pressure.

TRACTORS

1—10-ton Holt, Gas. Cat.
1—2-ton Holt, Gas. Cat.
1—5-ton Holt, Gas. Cat.

B. M. WEISS
1324 Widener Bldg., Philadelphia, Pa.